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London's Electricity Supply.

IN this issue we conclude a review of the London County Council's Return relating to electricity supply in the London and Home Counties Electricity District, for the year 1923-24, which comes opportunely when the Joint Electricity Authority has been constituted and the question of settling the standard prices to be charged by the London companies will shortly be taken in hand. Moreover, the current Return not only gives the data as usual for companies up to the end of 1923 and for local authorities up to March 31st, 1924, but for the first time includes the latest figures available for the companies—that is, up to the end of 1924. This is a convenience on which the compilers are to be commended. It is to be regretted, however, that the map showing the areas of authorised distributors in the Electricity District has not also been brought up to date; large spaces are shown uncoloured, although they have been allotted to various undertakers, and we believe it is correct to say that the whole of the District is now covered by statutory powers to supply electricity.

Undoubtedly the most interesting section of the Return at this juncture is that which deals with the methods of charging adopted and the prices charged by the various supply undertakings in the Electricity District. There are 89 authorised distributors in the District—44 local authorities and 45 companies—and they employ over 20 methods of charging; fortunately four methods predominate, namely: flat rate, sliding scale, maximum demand, and two-part tariffs. Amongst so many variables, it is not easy to institute a valid comparison, but taking the flat-rate charges only, the average decrease as compared with the previous year was in the case of lighting 3 per cent., power 18 per cent., and heating and cooking 9 per cent.

Of the metropolitan borough councils Poplar shows the lowest net revenue available for capital charges per kWh sold (0.61d.), closely followed by Stepney with 0.62d. Ten of the 16 councils received less than the average, which was 1.00d. Only one (Woolwich) drew upon the rates, to the amount of £2,844, and the net contribution in aid of the rates was £140,396.

Taking private lighting, power, and heating, with street lighting, the lowest revenue per kWh sold was at Woolwich (1.61d.), Poplar coming next with 1.65d., and Battersea and Stepney following with 1.81d. All the rest received more than 2d. The average for all was 2.26d.

Turning to the London companies, and excluding those giving only bulk supply, in 1924 the lowest net

revenue available for capital charges, 0.68d. per kWh sold, is credited to the London Electric Supply Corporation, which supplies energy to the Southern Railway; next comes the City undertaking of the Charing Cross Company with 1.06d. The average (including bulk supply companies, which received 0.35d. and 0.48d. respectively) was 1.84d.

For private lighting, power, and heating, with street lighting, no figure is given for the London Electric Supply Corporation, the revenue being lumped with that from traction; of the remainder, the lowest price per kWh sold is that of the South Metropolitan Company, 2.42d., the next in order being Westminster, 2.94d. The average is 3.14d.

The figures that we have quoted show that, roughly speaking, the London companies charge their consumers 40 per cent. more than the metropolitan borough councils do.

The Turbine Failure at Vereeniging.

THE breakdown of a turbo-generator at the Vereeniging power station of the Victoria Falls & Transvaal Power Co. on Monday last week was happily unattended by loss of life; but otherwise it appears to have been exceptionally thorough, the generator having been burst into fragments. The other three machines in this 40,000-kW station were damaged, but two of them were soon on load again, and the third will shortly be ready for service. By Thursday last week 95 per cent. of the normal peak load on the Company's system was being handled, as might be expected, seeing that the rated capacity of the several stations belonging to the Company aggregates 216,000 kVA.

The Vereeniging plant was set in operation in 1912; it is the second largest on this huge power system, which is fully loaded and works at a load factor of 70-80 per cent. A new power station at Witbank is being built by the Company on behalf of the Electricity Commission of the Union of South Africa, but will not be ready for use for some months to come. Quite recently the engineers were congratulating themselves on the fact that the boilers, many of which had been in use, heavily loaded, for 17 years, were as good as new and more efficient than when installed, but they have not been so fortunate with the turbo-generators, several of which, of German construction, gave them a good deal of trouble before the war.

The question arises whether the breakdown was due to a defect in design or material, or to age. At present we can but speculate on the matter, having no definite information regarding the origin of the fracture. When it is considered that the bending stresses in the shaft of a turbine running at 1,000 r.p.m. under the conditions obtaining on the Rand undergo some 8,000,000,000 reversals in 13 years, it will be seen that even the comparatively light stress involved may ultimately produce cumulative molecular effects of considerable importance. Up to the present we know of no other instance in which a turbine has "exploded" after many years' running, and it may be found that fatigue was not the cause of the Vereeniging breakdown.

Progress in Illuminating Engineering.

THE opening meeting of the Illuminating Engineering Society on November 26th was, as usual, marked by a good display of novelties. New arc lamps, colour projectors, motor-car headlights, and lighting fittings were amongst the exhibits. But of even greater interest, possibly, is the glimpse given in Mr. L. Gaster's report of the work on illumination that is going on simultaneously in so many different quarters—all ingeniously inter-related. The Committee working under the Department of Scientific and Industrial Research is a creation peculiar to this country. Its authoritative and impartial character lends special importance to its conclusions on industrial lighting. Evidence from this quarter with regard to the benefits of good illumination would be extremely valuable to the lighting industry, and we hope that before long it will be possible to make public some of its conclusions. Very useful work is also being done by the various B.E.S.A. committees. An informative standard specification for illumination photometers has recently appeared, and the work already done with regard to lamp standardisation is distinctly valuable. The amount of conscientious honorary work done by the members of such committees deserves more gratitude and recognition than it receives.

The second point emphasised at the meeting is the rapid growth of interest in illuminating engineering abroad. In the United States the Illuminating Engineering Society and its associated bodies have been conducting propaganda on a remarkably wide scale. We note that there are now three distinct societies interested in illumination at work in Germany, and Czecho-Slovakia is apparently to be reckoned as one of the latest recruits. There is no doubt that illumination is now entering the international phase, and it is therefore most desirable not only that there should be in this country a strong and well-supported body capable of voicing the national interests, but that this country should take a proper share in the international conferences of the future.

Swiss Industry Feels the Effect of Competition.

THE Commercial and Industrial Association of Switzerland recently issued a review of trade and manufacture in 1924, based on official statistics of imports, exports, &c., and on the detailed statements furnished by the different trade and group associations throughout the country. There was a general improvement in the activity of the machinery industry, unemployment having to a large extent disappeared and production having assumed a more stable character. The number of workpeople in 1924 exceeded the pre-war level, whilst the total exports of machinery and vehicles amounted to 53,500 tons, or a net increase of about 3,200 tons. Whilst the total value of the exports rose from 157 million fr. to 172 million fr., the average value per kg. fell from 3.35 fr. in 1923 to 3.22 fr. in 1924.

The progressive electrification of the Federal Railways was of great benefit not only to the electrotechnical industry, but to other enterprises. On the other hand, the export departments view future prospects with some anxiety. Nationalistic and fiscal tendencies, particularly in the countries directly affected by the war, have taken the form of extremely high protection for their home industries by the establishment of almost insurmountable Customs barriers. Consequently it is becoming increasingly difficult to export to certain countries which were formerly very good markets for Swiss machinery. It is felt that the loss of these markets will ultimately lead to unemployment. It is pointed out that wages in Switzerland remain on a much higher level than those in competing countries. The competition encountered in international markets has obliged Swiss firms to book contracts at unremunerative rates in order to provide employment at their works and maintain connections with their old customers. This may explain why the financial results of last year's operations were poor.

The makers of dynamo-electric machinery again complain of having to work under very unfavourable conditions of production compared with those prevailing abroad, especially in Germany. In consequence, they were frequenty obliged to accept orders at very low prices. On the whole, they experienced little difficulty in obtaining supplies of raw material, but paid increased prices for copper, brass, rubber, and, in particular, porcelain. The local electrification schemes brought considerable activity to works supplying railway material, distribution apparatus, and telephonic material, but makers of insulating material express themselves as dissatisfied with the volume of Government orders. Certain electricity works in Switzerland, it is said, do not give sufficiently favourable consideration to the local product, with the result that makers have been obliged to reduce their prices to an unreasonable level under the threat that the order would otherwise be placed in Germany.

Great Britain's Foreign Electrical Trade.

VOLUMES II and III of the annual statement of trade of the United Kingdom have just been issued. They include details of the import and export trade of the country in electrical machinery and apparatus, distinguishing the principal countries of origin or destination and the various main groups of productions. Comparative figures are given as far back as 1920. In considering these, it must be borne in mind that since April 1st, 1923, the trade of Great Britain and Northern Ireland with the Irish Free State has been included, whilst the direct foreign trade of the Irish Free State has been excluded. The effect of this alteration may be gauged from the following figures showing the total value of electrical exports from this country to the Irish Free State: 1923 (nine months), £120,560; and 1924, £378,540. In comparing last year's returns with those of preceding years, the price factor must not be lost sight of. In the returns relating to machinery, weights as well as values are recorded, thus furnishing a better guide to the real trend of trade. At the same time some allowance must be made for the alteration since the war in the design of generators and motors, less metal now entering into the construction of a machine of equivalent capacity and value. From fig. 1, showing the total imports and exports of electrical machinery in 1913 and from 1919 to 1924, certain broad tendencies are discernible. Imports, in weight, are scarcely within measurable distance of returning to their pre-war level; in value, they are slightly more than in 1923 but less than in 1922. Exports are about fifty per cent. over their 1923 level in weight and thirty per cent. in value. Compared with 1913, they are 4,200 tons more in weight and £3,000,000 more in value, surpassing the previous peak in value which was attained in 1921.

It is noteworthy that since 1919 the weights and value of imports have been strictly proportional.

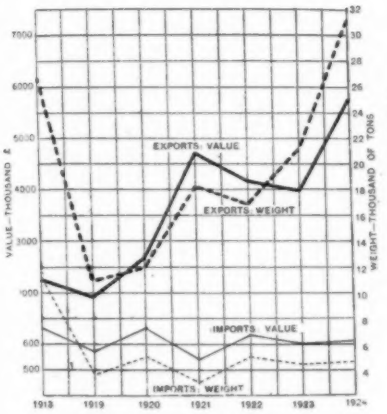


Fig. 1.—Imports and Exports of Electrical Machinery.

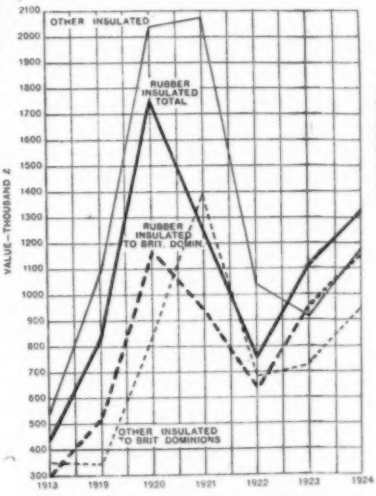


Fig. 2.—Exports of Cable (not Telegraph or Telephone).

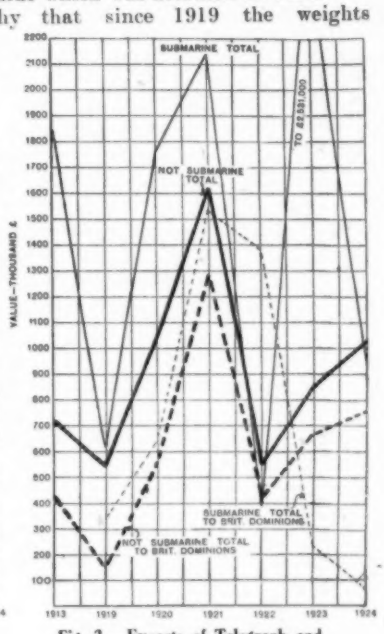


Fig. 3.—Exports of Telegraph and Telephone Cable.

Turning again to imports of electrical machinery, the largest item (as in 1923) is d.c. motors, although there has been a decline in this item. The totals last year and in 1923, with the chief supplying companies, are as follows:—

	1923. Tons.	£	1924. Tons.	£
Total ...	659	182,240	560	159,450
From Sweden ...	158	21,260	45	5,340
,, Germany...	81	12,520	184	21,090
,, Switzerland	46	10,975	21	6,260
,, U.S.A. ..	288	121,300	246	107,650

Imports of a.c. motors also are less than in 1923, *viz.*, 568 tons, value £74,400, against 681 tons, value £90,000. Of the 1924 total, £29,000 is credited to Sweden, £17,800 to the United States, and £9,800 to Germany, the share of the last-named in 1923 having been rather less. The value of the imports of "electrical machinery not elsewhere specified" is given as £611,000. This seems a large proportion of unclassified plant out of a total of nearly £1,100,000.

The steady upward course of our export trade in railway and tramway motors is strikingly shown in fig. 4. As in 1923, it accounted for about nine per cent. of the

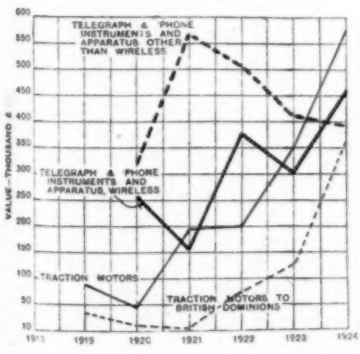

TELEGRAPH & PHONE INSTRUMENTS AND APPARATUS OTHER THAN WIRELESS
TELEGRAPH & PHONE INSTRUMENTS AND APPARATUS, WIRELESS
TRACTION MOTORS
TRACTION MOTORS TO BRITISH DOMINIONS
VALUE—THOUSAND £

Fig. 4.—Exports of Radio, Telephone, etc., Apparatus and Traction Motors.

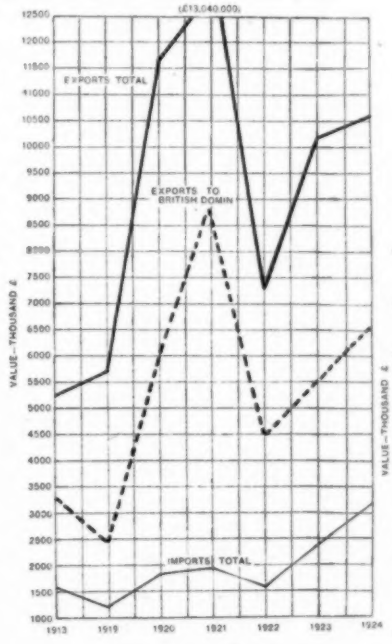


Fig. 5.—Imports and Exports of Electrical Goods and Apparatus.

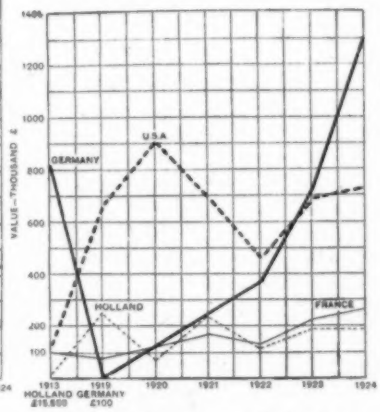


Fig. 6.—Origin of Imported Electrical Goods and Apparatus.

total value of our electrical machinery exports, whereas in 1919 the proportion was less than 5 per cent. The important place taken by Empire markets in this trade is also shown in fig. 4. It will be noted that the value of exports to those markets last year was five times that in 1922. To the Union of South Africa, shipments of railway and tramway motors rose in value from £6,500 in 1922 to £11,700 in 1923 and £208,300 in 1924.

The Empire is also our best customer for other motors, having last year taken a.c. types to the value of £446,400 out of a total of £568,900, and d.c. types to the value of £392,900 out of a total of £499,800. Of the former, exports as a whole are rather better than

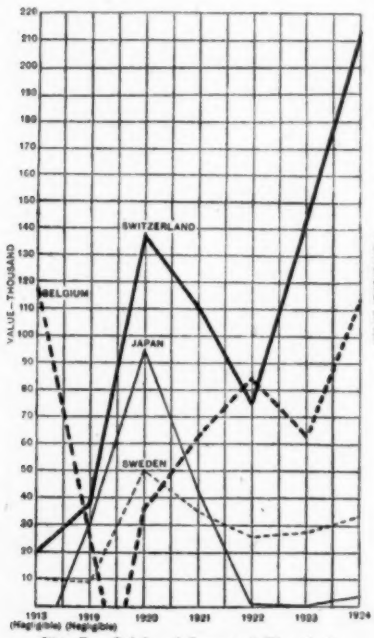


Fig. 7.—Origin of Imported Electrical Goods and Apparatus.

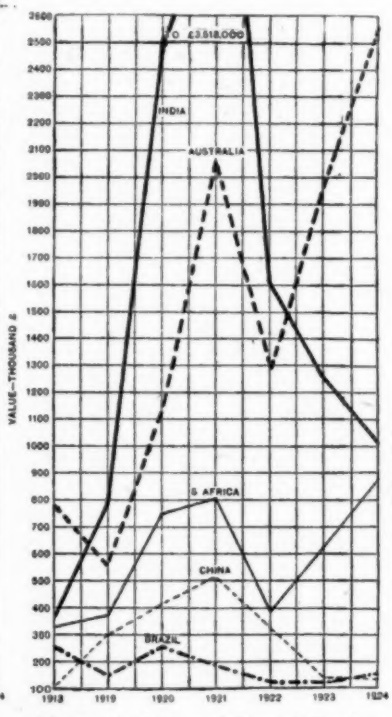


Fig. 8.—Destinations of Exported Electrical Goods and Apparatus.

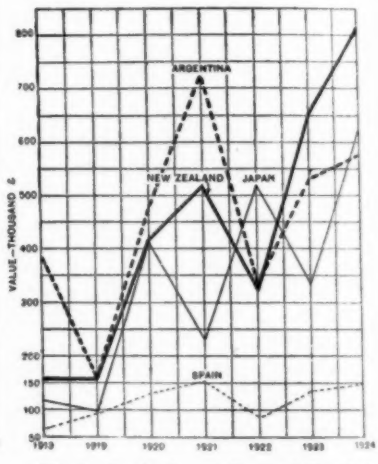


Fig. 9.—Destinations of Exported Electrical Goods and Apparatus.

in 1923, but below the 1921 and 1922 levels, whilst shipments of d.c. motors are seen to be slightly higher in value but lower in weight than in 1923. India is not such a good customer as in past years, but Australia is a better one. The total exports of motors (other than railway and tramway) are shown below:—

	1921.	1922.	1923.	1924.
Motors, a.c., tons	3,928	3,185	3,293	3,640
Motors, a.c. ...	£1,051,300	755,930	555,500	568,900
Motors, d.c. ...	£668,700	404,040	498,250	499,800
Motors, d.c., tons	2,521	1,768	2,907	2,845

It is interesting to note also who are our principal customers for generating plant:—

British Exports.

	A.c. Generators.			
	1923. Tons.	1924. Tons.	1923. £	1924. £
Total	2,452	4,671	494,000	707,800
To India	340	521	60,780	79,160
,, Australia	547	804	135,900	125,390
,, New Zealand ...	161	354	23,080	52,316
,, S. Africa	143	409	37,240	75,630
,, Spain	375	18	86,990	1,266
	D.c. Generators.			
Total	1,854	3,283	380,500	544,600
To India	429	624	80,110	115,890
,, Australia	402	493	99,455	104,380
,, New Zealand ...	132	42	24,670	6,130
,, S. Africa	85	1,078	16,020	131,100

Exports of Electrical Goods and Apparatus.

Besides giving details of the trade in some of the chief classes of electrical machinery, the annual statement also divides the trade in electrical goods and apparatus into its principal groups, *e.g.*, telegraph and telephone material, cables, batteries and accumulators, and lighting accessories. An analysis of these statistics reveals the importance of our export trade in cables, the progress of which in the more important classes is shown graphically in figs. 2 and 3. The total of the submarine group calls for special comment. It shows up unfavourably in contrast with 1923, because in that year there was an exceptionally large export to the United States (value £2,131,000). America appears again as a good customer in 1924, and it will be noticed that the grand total is considerably more than in 1922, although less than in the "boom" years of 1920 and 1921. In the other groups, trade is fairly good, and to a very large extent with the Empire, as will be seen from the charts mentioned.

The general trend of the export trade in telegraph and telephone instruments is shown in fig. 4, distinguishing wireless from other types. The telegraph and telephone branch is a healthily growing trade, foreign as well as Empire sales being much larger in 1924 than in 1923.

For radio instruments and valves, our principal customers are as follows:—

	1922. £	1923. £	1924. £
Radio instruments.			
Total	377,000	309,000	465,000
To Spain	10,730	9,720	19,120
,, Greece	200	16,700	10,900
,, Japan	173,600	98,640	164,600
,, India	54,450	18,940	14,000
,, Australia	2,320	22,700	74,400
Radio valves, vacuum tubes, and X-ray tubes.			
Total	39,500	84,600	176,000
To Japan	6,000	21,000	37,600
,, India	1,200	7,000	10,300
,, Australia	2,400	12,400	30,680
,, S. Africa	3,100	2,700	24,600

Lamp exports show a slight advance and imports a slight decline, thus bringing the balance yet a little further in our favour. The supplying countries in 1924 are seen to be about the same as in the preceding year: Holland, £96,000; Austria, £51,000; and Germany, £37,000. Our best customer for lamps is Australia, which figures with gasfilled lamps to the value of £34,600, and other glow lamps to the value of £83,000 out of a total of all kinds of £341,000.

Fig. 5 shows the relative position of the total import and export trade in 1913 and since the war (omitting 1914-1918 as being abnormal years) in electrical goods and apparatus, together with the proportion of exports that have gone to the British Dominions.

This introduces the question of the countries now supplying our imports of electrical goods and apparatus and how their respective shares have varied in recent years.

Figs. 6 and 7 show the values of the imports (retained for consumption) of this group, in recent years and in 1913, from the principal countries of origin. It will be noticed that the value of Germany's imports is now above pre-war level. The increase in the grand total

from all countries is spread over nearly all the principal groups. For example, imports of wireless goods are nearly double in value compared with 1923, whilst those of other telegraph and telephone apparatus show an increase of nearly 60 per cent. The battery and accumulator group show advances in value of about 150 per cent., and the imports of lighting accessories and fittings an increase of nearly 50 per cent. In every case Germany has considerably advanced her position. There is an increase in the value of imports of rubber-insulated wires and cables (not telegraph or telephone), in which Germany, Belgium and Switzerland all share. Amongst minor importers Austria, Hungary and Denmark are becoming more noticeable.

Finally, Figures 8 and 9 show graphically the progress of our trade in electrical goods and apparatus with the principal consuming markets. Promising South American outlets other than those shown in the charts are as follows:—

Exports to:	Peru. £	Chile. £	Uruguay. £
1913	10,500	77,600	15,900
1919	108,700	57,400	8,500
1920	341,500	87,800	28,800
1921	16,700	266,000	17,600
1922	4,450	288,000	7,800
1923	64,700	101,000	50,000
1924	34,700	116,000	18,000

Choosing and Using an Electric Washing Machine.

Introducing the "Gaslectric" Washer.

By N. L. W. E.

"WASHING machines in the United States.—The American Washing Machine Manufacturers' Association reports that during the first quarter of the current year its members sold 197,764 washing machines, of which 160,353 were electrically operated. In the equivalent quarter of 1924 the total number of machines sold was 179,461, and of these 148,847 were electrical."—ELECTRICAL REVIEW, June 19th, 1925.

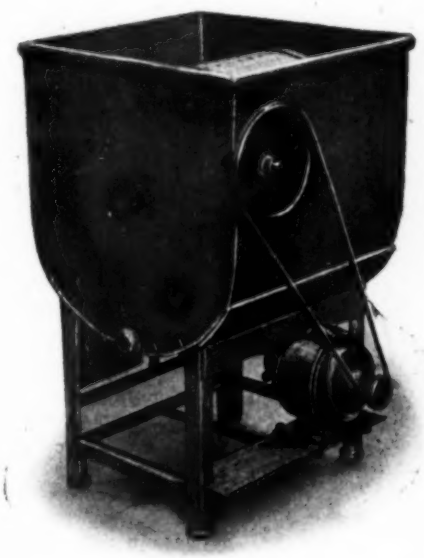
I was greatly impressed by "Wren's" article, and your editorial, on "Choosing a Washing Machine" in the ELECTRICAL REVIEW of September 4th and 11th. Like him, I was required to foot the weekly wash bill, and also the incidental losses due to damage and replacements. Realising the advantages and, incidentally, the load-building potentialities of the electric washer, I also made inquiries with a view to purchase, but was deterred by the high price—£45 to £60. Not to be denied, I constructed a machine at less than one-third the cost of the cheapest machine then on the market, to which I geared a ¼-h.p., a.c., squirrel-cage motor.

From this beginning, and after more than three years' concentration on the subject, there has been evolved an electric washer which embodies not only the desirable features enumerated by "Wren," but also several more important points which, so far, he has not mentioned. These, with the Editors' permission, I will now endeavour to amplify and explain.

Apart from their high price, many of the machines at present offered are too large, not only in size, but in washing capacity, for the average-size family and for the floor space available. Existing machines are often constructed largely of wood, which not only tends to absorb the washing liquor and to become insanitary, but, when not in use, is liable to shrink and leak. With few exceptions, existing machines have to be supplied with hot water, which, during the washing operation, gradually cools. Any steam-laundry operative knows that in order satisfactorily to wash cotton and linen articles, the initial temperature should be but moderate to prevent the fixation of stains, &c., and gradually increased until, finally, a bleaching and sterilising temperature is attained. This consideration is fundamental if the purity and "colour" of linen articles are to be maintained, and involves the provision of a heating element, which most existing machines do not possess, if the necessity for a separate boiling "copper" is to be avoided.

Moreover, existing machines with automatic reversing gears and geared wringers necessitate frequent attention if failure due to insufficient lubrication is to be avoided.

As "Wren" points out, there are many different types of washing machines of American and European manufacture, but those which are driven by electricity have, so far, failed to attract the British public. One cause of failure has undoubtedly been the unnecessarily high cost of production, and the consequent high price, of the machines so far designed and offered. There are possibly other contributory causes of failure, but it is mainly the high price which has limited the market to the relatively wealthy classes, who, however, can easily afford to patronise the steam laundries, and are



The "Gaslectric" Washing Machine.

not interested in saving money or labour by having washing done at home. Moreover, the electric washers offered to the public are, in fact, combined washing and wringing machines. The wringer attachment contributes very largely to the cost of the machine, as will readily be understood, and apart from introducing a somewhat dangerous piece of power apparatus (several serious accidents have occurred), the wringer does not completely take the place of the combined wringing and mangling hand-operated machine, which, in Great Britain, is regarded as an indispensable requirement of every modern household; that is to say, such large articles as bed-sheets, table-cloths, bed-spreads, and

blankets, which do not require ironing, must be finished, if washed at home, by means of the family mangle. As the mangle invariably serves also as a wringer, the difficulty of selling an additional wringer, attached to a washing machine, at a relatively high price, will readily be perceived.

It may be assumed that in the average British home mechanical skill is practically non-existent, and complicated instructions as to oiling and adjusting and operating emergency release mechanism in case of accident tend only to frighten prospective users. It is claimed by the makers of the "Gaslectric" washer that they have constructed a machine which not only eliminates these disadvantages, but also possesses advantages from both the utility and selling points of view which have not hitherto been offered or provided, the net result being a machine of sound engineering design and construction, of proved utility, at a cost which enables the price to the public to be kept within the reach of practically every one who occupies a house supplied with electric current. This has been accomplished—

(1) By eliminating the geared wringer, but the machine is built strong enough to have a hand wringer (cost 25s.) attached if desired.

(2) By running the main machine-cut speed-reducing gear immersed in the soapy washing liquor, no other oil lubrication being required. The belt (sewing machine type) drive to the motor provides the necessary safety device to protect the motor. The gear consists of a polished shaft of stainless steel, running in ball bearings, and a cut gunmetal worm wheel mounted directly on the rotary drum.

(3) By providing gas-heating apparatus to maintain the liquor at the correct temperatures for washing woollen articles, cottons, and linens, and also for boiling and sterilising. Being a gas-using appliance, it is an attractive proposition to gas-supply as well as electricity-supply authorities—an important consideration from the sales point of view, especially where both gas and electricity are supplied by one authority.

(4) The machine is constructed mainly of galvanised steel, a material which for generations has proved its utility for this purpose in this country. The machine is therefore perfectly sanitary, non-rusting, and non-shrinking when not in use.

(5) The machine occupies the minimum of floor space (17 in. by 21 in.), and is provided with a strong flat-topped metal cover, which serves also as a useful side table when placed in a scullery or kitchen, as it would almost invariably be in this country.

(6) The machine is practically silent in operation, and functions on the well-known rotary-drum principle, the effectiveness of which cannot be gainsaid; but unlike all other rotary machines, it is so designed that the need for automatic reversal of rotation has also been eliminated. The result of these features, which form the principal claims in the British patent, is a rotary washing machine of the cheapest possible construction consistent with sound engineering design. The effectiveness and general utility of the machine have been proved by regular use for more than three years, during the past year of which neither the machine nor the motor has been oiled or attended to by any skilled person. Apart from a heavily-insulated press-button switch (Home Office pattern), the machine has no mechanical controls. Smooth-running, rustless "domes of silence" are fitted instead of iron castors, which stain the floor with iron-mould, and are very liable to cause trouble.

The Theory of Mechanical Washing.

The accepted story of the cleansing process is, in the rotary machine, repeated immersion of the articles in *hot* soapy liquid, partial draining of the articles by lifting and slight pressure, and re-immersion, in order to cause free and continuous circulation of the liquid through the fabric. In the "Gaslectric" washer the special formation of the rotating drum—which is unique in power-driven washing machines, and, therefore, unfamiliar to experts in laundry operations—enables the washing process to be completed satisfactorily by rotation in one direction only. The time required, other conditions being equal, is not materially different from that of the two-way machine, as anything in excess of the recognised maximum effective speed (16 r.p.m.) tends, by centrifugal action, to retard complete washing, whatever the type of machine.

That the "Gaslectric" washer is satisfactory and effective, in completing the washing process, is proved satisfactorily by long experience, and also by independent and hypercritical inspection of the articles washed. Further proof is the entire lack of evidence of undue wear, although many articles have been washed by the machine every week for two or three years.

The Potentialities of the Electric Washer.

Referring now to the opening paragraph of this article, indicating the enormous business done in electric washers in the United States, it should be unnecessary to point out that the domestic consumer offers at the present time the greatest possibilities for economical electrical development. This field is in this country practically untouched, so far as electric washers are concerned, and energetic development should yield a splendid return to all concerned. Casual observation during the early part of the week will show the immense extent to which the washing and drying of clothes is carried on in residential districts of all classes.

It has been stated on the highest authority that 90 per cent. of the country's weekly wash is still done, more or less laboriously, at home by hand. The true significance of these facts, from the sales development point of view, does not appear to have been fully appreciated by British manufacturers and electricity supply authorities, if one may judge by the limited number of excellently-appointed, but relatively high-priced, electric washers hitherto available.

To these and all others interested in mitigating household drudgery by promoting the use of domestic labour-saving devices, the main feature of the "Gaslectric" washer is its relatively low price, which is about half that of the next lowest-priced washer of its class now on the market.

The capacity of the No. 1 or smallest "Gaslectric" washer is one full-sized blanket, or four full-sized sheets, or the equivalent in other articles. The motor is also of British manufacture, self-oiling (ball bearings), insulated, suitably protected, and of $\frac{1}{8}$-h.p. capacity.

I can endorse all that "Wren" has said of the electric washer as a money, time, and labour saver. Bed-linen, for instance, can be, and, in my own experience, frequently is, washed, dried, finished, aired, and replaced in use during the same day.

The "Gaslectric" washer is fully protected by British patent, and the makers (Messrs. T. Balmforth and Co., Ltd., Luton) state that they are in a position to give early delivery.

Royal Institution.—The lecture arrangements at the Royal Institution before Easter next year were announced at the general meeting of the members on December 7th. The Juvenile Lectures, the 100th Course, will be delivered by Sir William Bragg on "Old Trades and New Knowledge," commencing on December 29th, at 3 o'clock. On Tuesdays, at 5.15, beginning on January 19th, there will be two lectures by Dr. J. A. Crowther on "X-rays and Living Matter," two by Dr. E. K. Rideal on "Surface Action," four by Professor Barcroft on "The Egg," and two by Dr. C. H. Desch, on the "Growth of Crystals." On Thursdays, *inter alia*, there will be three lectures by Dr. C. D. Ellis on the "Atom of Light and the Atom of Electricity." On succeeding Saturday afternoons there will be four lectures by Sir Ernest Rutherford on the "Rare Gases of the Atmosphere and their importance in Atomic Theory." The Friday evening meetings will begin on January 22nd, when Sir William Bragg will deliver a discourse on the work of the Davy Faraday Research Laboratory. Succeeding discourses will probably be given by Sir J. J. Thomson, Sir Ernest Rutherford, and other gentlemen.

Electric Washing Machines.—I.

THE electric washing machine has not made much headway in this country if judged by the United States standard, but there is little doubt that a market exists if efforts are made to meet the requirements—both constructional and financial. The first cost of a washing machine is undoubtedly heavy; this is a serious handicap which has a greater effect in this country than in the United States. Even in the latter country, however, arrangements are made to spread the cost over a year or two, and this has much to recommend it. On this basis it is much easier to compare the cost of electrical washing with older methods. Account is taken of weekly laundry charges or the cost of assistance in the home, &c., and the amount is placed side by side with the periodical payments made for the machine, when it is seen that if there is a difference in favour of the older methods, it is more than outweighed by non-pecuniary advantages.

By intensive advertising and the adoption of the instalment system of payment, a huge business has been built up in the United States. According to a recent statement which appeared in the *Electrical World*, there were 50,000 electric washing machines in use in the United States in 1914. Ten years later, in 1924, the number had grown to over 4,000,000, the value of the machines being put at $600,000,000. At the present rate of growth, it is estimated that in 1929 there will be over 7,600,000 electric washing machines, or, allowing an increase in the rate, 9,000,000. It is estimated that in 1929 the replacement rate alone will be 700,000.

So far as can be ascertained, sales of electric washing machines in Great Britain represent only an infinitesimal fraction of the American figure, Domestic drudgery is hard to eradicate in this country, but there must surely be a bigger market for these machines than the sales would indicate.

In an endeavour to stimulate interest in the subject, we illustrate below several examples of British washing machines. The term "British" has had to be extended to include machines from the other side of the Atlantic which are supplied by British firms.

Two kinds of washing machine are marketed by the General Electric Co., Ltd. The first (fig. 1) is not strictly a "machine," for there are no moving parts, the work being done by the circulation and percolation of hot water. It consists of a galvanised iron tank, with heating elements fitted in the base, and a vertical tube passing upwards through the centre of the tank. It is made in 10-gal. and 14-gal. sizes and provision is made for the fixing of a wringer. The other "Magnet" washer is illustrated in fig. 2. This is a compact machine designed on rational lines employing the reciprocating perforated cylinder operating in the tank which forms the body of the appliance. Simple controls are provided and the motor is of the enclosed pattern placed well out of the way. A swinging wringer is fitted in a convenient position.

Messrs. Whittaker Bros. (Accrington), Ltd., produce the "Electric Pioneer" washing machine illustrated in fig. 3. Wood is largely employed in the construction of this machine, the water box well being made of Louisiana cypress and the revolving drum of hardwood and tinned woven copper wire. The driving gear is placed on either side to suit the buyer's convenience and is covered in by a wire guard. The size of the wringer (24 in. by 6 in. brass-capped rollers) is somewhat uncommon, most electric washers being equipped with much smaller wringers. The machine is mounted on castor wheels to facilitate movement. A .5-h.p. motor provides the drive.

The "Laundry Queen" washing machine, shown in fig. 5, is sold by the Northern Steel & Hardware Co., Ltd. This is of very simple construction, consisting of a wooden tub mounted on a square frame fitted with castors. Through the lid of the tub passes the shaft of a rotating dolly or "Turbo-Vac." This dolly has four arms, each of which consists of two cupped wings which set up a suction as they rotate and draw the dirt from the clothes in the tub. The wringer can be easily swung and locked into any position and the drive of the rollers allows both forward and reverse motion.

Fig. 4 illustrates the "Western Electric" washing machine supplied by Standard Telephones & Cables, Ltd. This appliance is of handsome appearance, having a grey enamel body, top and cover of polished aluminium, and nickel-plated control handles. The clothes are placed in a perforated cylinder which is arranged to make six revolutions in each direction alternately. The wringer, fitted with an all-metal drain board of generous proportions, is supported at one end by means of a vertical arm above the washer. Overloading is prevented by safety friction clutches on the washer and wringer drives. All the mechanism is totally enclosed but easily accessible for cleaning.

Fig. 1.—A G.E.C. Washer.

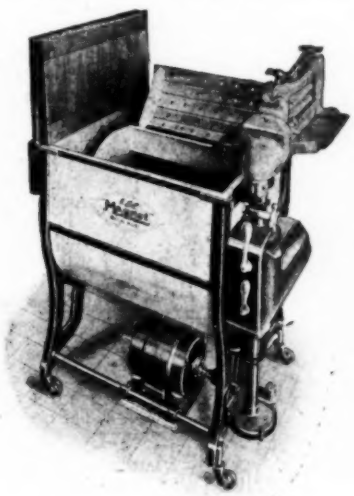


Fig. 2.—The "Magnet" Washer.

Fig. 3.—The "Electric Pioneer" Washer.

Fig. 4.—The "Western Electric" Washer.

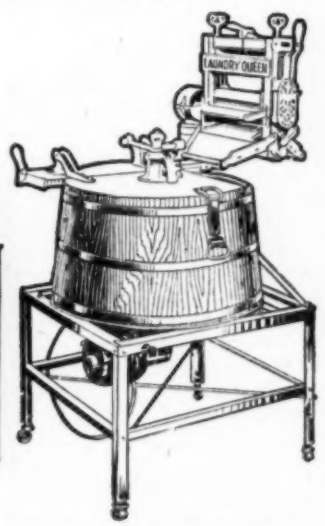


Fig. 5.—The "Laundry Queen" Washer.

Messrs. L. G. Hawkins & Co., Ltd., supply the "Universal" washer depicted in fig. 6. From the illustration the construction and operation of the machine can be clearly seen. It has a sheet steel body beautifully finished in blue enamel and the clothes are put into a reversing perforated cylinder of non-rustable metal. The drive is wholly by gears which run in an oil bath and are noiseless, the motor having a rating of 0.25 h.p. It is claimed that six full-sized sheets can be washed in this machine in 15 minutes. The wringer is fitted with a safety release device and an overload release is also provided.

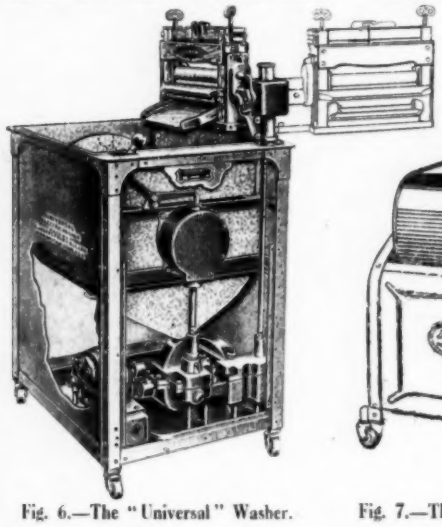


Fig. 6.—The "Universal" Washer.

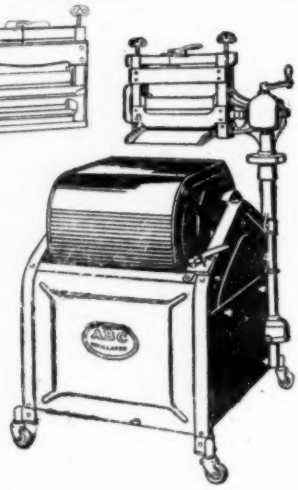


Fig. 7.—The "A.B.C." Washer.

One pattern of the "A.B.C." washer sold by the Sun Electrical Co., Ltd., is shown in fig. 7. This is a semi-enclosed machine with a rocking tub. The agitation of this tub forces the hot water through the clothes at each movement. The tub is of copper and is tinned on the inside. When not in use the tub is locked into a vertical position. A swinging wringer, with a reversing lever, is fitted, and this, as usual, is equipped with a quick-acting safety release. The body is finished in grey enamel.

Messrs. Duncan Watson & Co. are the agents in this country for the "Rotarex" machine illustrated in fig. 8. This is also of the reversing-cylinder type fitted with a wringer. The body is constructed on plain lines and is mounted on four legs fitted with castors. The driving gear is well enclosed and the motor is mounted underneath the tank.

The last example (fig. 9) is the "White Cap" washer which

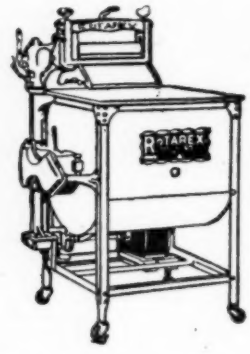


Fig. 8.—The "Rotarex" Washer.

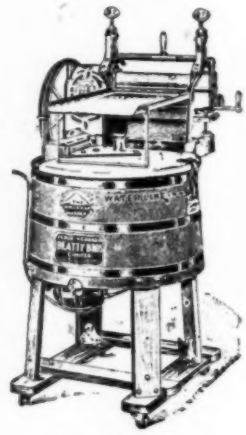


Fig. 9.—The "White Cap" Washer.

is made in Canada by Messrs. Beatty Bros., Ltd., who also market the machine in this country. The body of this consists of a wooden tub mounted on a framework of the same material. The machine operates on the dolly principle, this member being fitted in the lid of the tub. The wringer is driven by a belt which operates a rather large wheel.

Super-Station Switchgear.

The Trend of Modern Practice.

By A. MENTOR.

THE supply of switchgear to meet adequately the demands of modern large super-power stations is a subject of first-grade importance to the electrical industry in this country owing to the very large extensions and interlinkages which are now under construction or being actively contemplated.

The supreme importance of maintaining supply is fully recognised in all quarters, and there can be no question that the aggregation of large power units, bigger power stations, and the interlinking of these stations, together present to the designers and manufacturers of switchgear a number of problems of grave difficulty; upon the correct solution of these difficulties very heavy issues are at stake.

A cursory examination of switchgear equipments as installed in the most recently designed stations will at once reveal that there is no unanimity of opinion as to the design of oil circuit breakers or the physical design and lay-out of the switchgear best suited for the duty, and the standardisation of practice in even the moderate-sized station is apparently a long way from being an accomplished fact. Whilst there are undoubtedly the elements of progress inherent in the trial of various expedients to accomplish a given end, the position is only satisfactory in so far as such expedients have for their basis a proved ability to accomplish that end; and in this respect the position is unfortunately not as strong as could be desired when considering very large stations.

The actual rupturing ability of oil circuit breakers in major stations should be beyond question, and extrapolation from small designs is hazardous when tests to confirm new and larger designs cannot be made; furthermore, experience from casual happenings in operation cannot be relied upon to make good any deficiency, owing to the impossibility of securing adequate observation of the various phenomena which occur, and to the known inconsistency of performance even under tests which are controlled to the maximum degree possible.

That there is not available testing plant capable of stressing to their limit designs which are now in common use in this country, is a matter for great regret; and the degree of benefit to be derived from the experience of foreign designers who have proper test facilities at their disposal is necessarily restricted to one or two firms having access to the researches of big manufacturing companies abroad. The inability to make tests which will define the limit of safe operation will naturally reflect on the breaking ratings ascribed to oil circuit breakers, and much divergence of opinion is noticeable when breakers having the same nominal rupturing capacity are compared with each other—showing that, at best, only empirical design data, little better than guesswork, have been available.

Similarly, the arrangement of switchgear in general, and its physical design, display variations which can hardly be reconciled with an accepted and uniform degree of safety in operation. This broader aspect of switchgear safety is, of course, beyond the region of experimental test and proof and the adequacy of designed layouts to fulfill their function can only be established by satisfactory experience in service.

Fault conditions which would be capable of putting to the proof our super station switchgear have happily been of rare occurrence, and this in itself constitutes a high tribute to the care and thought which our switchgear engineers have displayed, but it should not be accepted

as a natural consequence that such a degree of immunity from trouble as has favoured us in the past will necessarily continue under the changed conditions which are impending, and furthermore, it must be remembered that the knowledge which such failures would have afforded has not been rendered available to guide practice in catering for our future requirements. It is necessary, therefore, to look very carefully into all the facts available, and to examine, particularly, such experience as has followed developments the most nearly approximating to those which we contemplate, in order to determine what our own future policy should be.

It is, of course, known that in the United States power stations of very large size, corresponding with some of those now contemplated in this country, are in active operation, and those who have watched the progress of events will be aware that during a period of a few years wherein such stations were being brought into commission, there was a considerable number of switchboard failures of a very disturbing magnitude, causing much dislocation of service and corresponding loss. As a result of knowledge brought to light by these failures, it is not too much to say that American practice on large switchboard installations underwent a complete change. This change has been exemplified in probably about twenty different stations constituting all the large installations which have been placed in commission since its inception.

The effect of a short circuit in, or close to, a power station having a quarter of a million kVA of generating plant is best left to the imagination, and whilst no effort should be spared in attempting to produce circuit breakers which can interrupt the maximum flow of energy which may be involved, the issues at stake are too vital to justify reliance on the circuit breaker alone as the only means of avoiding disaster.

It is possible, by the insertion of earthing resistances, to limit the flow of earth fault current to a value which can be interrupted readily and without disturbance to the system. Further, the application of current-limiting reactors can, in ways now well known, be made to provide some measure of limitation to the fault current which may flow between phases, and sectionalisation of bus-bars also will contribute to that end. Nevertheless, these provisions alone, because of their limitations as to application and operation, do not provide a sufficient safeguard for apparatus forming the very nerve centre of a large electrical power system, and search must be made for means of definitely preventing the occurrence of phase faults on main switchgear.

These are the considerations which led to the development in the United States of what is now known as isolated phase switchgear, the name of which serves to indicate that each phase is separated bodily from the others, as completely as can be accomplished. This is done either by vertical walls, as in the earlier installations, wherein the gear was installed in what were virtually three separate single-phase switch houses, or, as in the arrangement which has come to be regarded as standard practice, on three separate floors of one building. The latter arrangement allows that a longitudinally placed vertical dividing wall can produce six separate compartments, three for the main bus-bars and three for auxiliary bus-bars, and transverse walls can provide sectionalising barriers between various portions of each bus-bar.

Even with these precautions, trouble was not eliminated entirely until experience had demonstrated the steps which were necessary to ensure that the provisions made for simultaneous operation of the three phases of oil breakers and isolators could not be also the channel whereby trouble could spread from one phase to another.

Descriptions of the various installations carried out have been published from time to time, and it is not the purpose of this article to repeat this matter in detail. There are, however, in connection with such schemes, a number of points which are not immediately obvious from either a bare definition or a detailed description, and some of the outstanding points can be conveniently reviewed.

The main object accomplished in such gear is to ensure that within the premises of a super-station switch house there will be no point at which the phases are brought close together. The outgoing feeders, &c., may be three- or single-phase cables, or overhead lines, but the principle of separation must be carried through until the conductors pass beyond the switch house. Safety may, in many cases, demand that series reactors be placed in the run of the conductor from the switchgear to the cable sealing ends, and, in this event, the reactors for the different phases are necessarily separated in the same way as the remainder of the gear.

When duplicate bus-bars are provided and isolated from each other there must eventually be a common point at which the duplicated switchgear conductors arrive at the single out-going conductor, and it is necessary, if the maximum safety possible is to be actually achieved, that the common point be on the side of the oil circuit breakers remote from either set of bus-bars. It will at once be seen that this calls for duplicate circuit breakers as well as duplicate bus-bars. Owing to financial considerations it has not been the practice, heretofore, as a rule to use duplicate circuit breakers in this country. In view of the major developments impending in the next few years, however, it is suggested that this feature requires reconsideration, as no expense is too great to ensure immunity from breakdown at such vital points.

The question of cost is obviously one of great importance, and the first impression in regard to isolated-phase arrangements is that they must necessarily be more costly than the arrangements heretofore common in this country. This is not necessarily the case, since there are advantages inherent in the scheme which enable considerable price-saving to be realised. The matter of the space occupied is tied up very closely with the question of cost, and very careful estimates have been made to arrive at comparisons between equivalent equipments laid out according to the isolated-phase scheme and schemes of older form. The results show, in general, that the cubic space occupied is practically identical, and it is possible, therefore, to make comparisons based on engineering and technical considerations without being hampered by any material handicap from the financial point of view on either the one scheme or the other.

In summarising the advantages of isolated-phase switchgear arrangements, it may be said that:—

1.—Phase-to-phase short circuits on switchgear are impossible. The trifurcating box of a three-core cable, if such be used, is the nearest point to the bus-bars at which such an occurrence can take place, and series current-limiting reactors can, in the extreme case, be used to limit the value of current in such a fault.

2.—The large spacing which naturally results from the isolated arrangement of phases reduces to a very marked degree the electromagnetic stresses which can result from a fault external to the station switch house.

3.—High-voltage connections are simplified by their single-phase arrangement as no phase crossings are required, and in general their length can be materially reduced. The introduction of reactors were required can be more readily and conveniently effected.

4.—Flexibility of operation under emergency conditions is greater than on other arrangements as, owing to the complete physical separation, any phase can be worked on with complete safety, and the cramping effect of adjacent phases is removed.

5.—The operating solenoids or other mechanisms of the circuit breakers are removed from proximity thereto, and inspection is the more readily and conveniently carried out. Isolator mechanisms too can be arranged alongside the appropriate breaker mechanisms, and mechanically interlocked therewith by robust and visible devices.

These advantages are fundamental in character, and are peculiar to the system of arrangement, and their value cannot be questioned. In these circumstances it follows that engineers entrusted with the preparation of plans for the super-power stations of the future in this country cannot afford to ignore a switchgear scheme which had its origin in troubles experienced in stations of similar magnitude elsewhere, and which has given good service in the large equipments to which it has been applied.

Legal.

British Thomson-Houston Litigation.

THE injunctions granted *ex parte* on December 4th by Mr. Justice Tomlin in the Chancery Division to the British Thomson-Houston Co., Ltd., restraining R. H. Wood, E. A. Siderman, and Walter Thomas Smith, Ltd., from infringing its electric lamp patents by selling imported lamps, were mentioned to his Lordship on December 8th.

Mr. TREVOR WATSON, for the plaintiffs, said that Mr. Wilfred Hunt, for W. T. Smith, Ltd., wanted time to consider the matter, and he therefore asked that the motion against the company should stand over for a week on an undertaking. With regard to Siderman he asked for an interim injunction until the trial.

Mr. SIDERMAN, who appeared in person, said he was willing to submit to a perpetual injunction.

His LORDSHIP said that could not be done except by consent.

Mr. WATSON said that the third defendant, R. H. Wood, was evading service.

His LORDSHIP suggested that the *ex parte* injunctions against all three defendants should be continued for a week and that in the meantime the plaintiffs should consider whether they could put an end to it as against Mr. Siderman, as they ought not to incur any undue costs.

Mr. Watson agreed, and this course was taken.

The *ex parte* injunction obtained on December 4th by the British Thomson-Houston Co., Ltd., restraining the London Electric Lamp Co., of Sandcroft Street, Kennington, S.E., from infringing its electric lamp patents, was mentioned to Mr. Justice Tomlin in the Chancery Division on December 8th by Mr. Trevor Watson, who said that plaintiffs had not been able to effect service on the company, and he asked that the motion should stand over for a week in order, if possible, to trace the man who had to be served.

His LORDSHIP acceded to the request.

IN the Chancery Division on December 11th, Mr. Justice Astbury had before him a motion on behalf of the British Thomson-Houston Co., Ltd., for an injunction to restrain the Electric Service Company from infringing letters patent which Counsel said had been upheld by the Courts. An interim injunction had been granted over that day, and Counsel asked that it should be continued until judgment in the action or further order.

The defendants were not represented and his Lordship made the order.

British Insulated & Helsby Cables, Ltd.'s Pension Fund.

THE decision of the House of Lords on the appeal of the British Insulated & Helsby Cables, Ltd., against a judgment of the Court of Appeal in its dispute with the revenue authorities on income tax assessment for the year ended April, 1918, was given on December 11th. The company claimed to be entitled to deduct a sum of £31,874 made to a pension fund for the benefit of its clerical and technical staff in computing the profits for the purpose of assessment to income tax for the year ended April 5th, 1918, and appealed to the Special Commissioners on the point, with the result that their appeal was allowed. Mr. Justice Rowlatt upheld this decision, but the Court of Appeal reversed it. The final appeal was heard and judgment reserved on October 26th. By a majority their Lordships dismissed the appeal, the Law Lords taking this view being the Lord Chancellor and Lords Atkinson and Buckmaster, and the dissenting members being Lords Carson and Blanesburgh. The Lord Chancellor said that the object and effect of the payment of this large sum was to enable the company to establish the pension fund and to offer to all its existing and future employés a sure provision for their old age, and so to obtain for the company the substantial and lasting advantage of being in a position throughout its business life to secure and retain the services of a contented and efficient staff. He was satisfied, on full consideration, that the payment was in the nature of capital expenditure, and accordingly that the deduction of the amount from profits, although not expressly prohibited by the Act, was rightly held by the Court of Appeal not to be admissible.

Metropolitan Water Board v. North Metropolitan E.P.S. Co., Ltd.

MR. JUSTICE ROMER, in the Chancery Division on December 10th, delivered judgment on a special case stated by the Metropolitan Water Board raising the question whether the King George reservoir at Chingford came within the words "other source" contained in Section 15 (1) of the Electricity Supply Act, 1919, which states:—"The Board of Trade, on the representation of the Electricity Commissioners, may authorise any joint electricity authority, or any authorised undertaker, to abstract water from any river, stream, canal, inland navigation, or other source, to enable the undertaking to utilise and return the water, subject to such conditions as may be specified in the order."

His LORDSHIP said there was also the further question whether it was within the power of the Minister of Transport to authorise the North Metropolitan Electric Power Supply Co., Ltd., to abstract water from the reservoir. But inasmuch as the company was an authorised undertaker within the meaning of the section there could be no doubt as to the power of the Minister to make such an order if the first question was answered in the affirmative, if he was satisfied as the result of an inquiry that it was proper to make an order. With regard to the first and principal question his LORDSHIP said the words "other source" in the sub-section were not used in the sense that they were used when speaking of the source of a river or stream. The word "source" must mean some body of water from which water was capable of being abstracted and to which it could be returned. If a reservoir was not included in the words of the sub-section then it must be because the expression "other source" included a certain species only of such bodies. A reservoir was different from a river or stream in that it was exclusively appropriated for a definite purpose. But so was the water in a dock or canal. The fact of appropriation was not therefore a sufficient reason for excluding a reservoir from the scope of the words "other source." The plaintiffs had contended that having regard to the provisions of the section as a whole and to the purpose that the Legislature must have had in view, a reservoir must be taken to be excluded from its operation. He could, however, find no justification whatever for this. The plaintiffs also submitted that the sub-section only related to such water as could be abstracted without trespassing on land belonging to others; that the Minister had no power to enable anybody to pass over the property of a third party to do this; and that it was inconceivable that the Legislature intended to confer upon him the power to authorise interference with the rights of property without compensation. Of course it was true that the electricity authority or undertaker, though not the owner of land adjoining the water, might by agreement obtain the right to lay its pipes over the land for the purpose of abstracting and returning the water. But there could be no object in obtaining such a right, and he did not know that the authority or undertaker would have any power to obtain such a right, unless and until the right of abstraction was clear. In the circumstances he did not feel justified in reading into the sub-section a qualification of the power of the Minister to make an order that was not expressed. When the order was made it might be that the authority or undertaker would not be able to get to the water for abstraction purposes unless and until it obtained right of access. As to that he did not feel called upon to express an opinion. All he proposed to do at the present time was to declare that the King George reservoir was a "source" within the meaning of the sub-section.

An Electrical Trades Union Dispute.

MR. JUSTICE TOMLIN, in the Chancery Division on December 11th, had before him a motion on behalf of the officials of the London (East) branch of the Electrical Trades Union for the discharge or variation of an order made on January 30th last on an injunction obtained by the Electrical Trades Union, so as to give the branch officials liberty to make urgent payments out of funds subscribed by the branch members.

Mr. GALBRAITH, K.C., for the branch officials, said there was a dispute between them and the Union, the branch having been suspended on the ground that certain rules had been broken, which was denied. Since the order was made £700 had been contributed by members of the branch, and the question was: Who ought to pay the benefits? There were some members living in West Ham who owing to the dispute could not get the benefits they had paid for and were drawing relief on loan from the Guardians. As a way out of the difficulties he suggested submitting a list of the urgent cases to the head office with a request that they be dealt with.

Mr. NORMAN DAYNES, for the Union, said he did not wish to contend that the effect of the suspension of the branch was to deprive members of the benefits they were entitled to. He was willing to consider the suggestion Mr. Galbraith had made.

His Lordship adjourned the motion until December 15th, to see if the parties could come to some arrangement.

Claim by the Dublin United (Electric) Tramway Co.

MR. GEORGE HEWSON, official arbitrator appointed by the Free State Government, heard evidence recently in the City Hall, Dublin, in respect of a claim by the Dublin United (Electric) Tramway Company for £20,000 for property formerly occupied as offices and stores in Upper O'Connell Street, which the City Commissioners propose to acquire for street-widening purposes. The main portion of the property was destroyed in the insurrectionary fires of 1916 and has since been lying derelict, the company having acquired new premises. Evidence of value was submitted by the company and the Commissioners, the latter's valuation being £2,500. The award will be made in due course.

Bowerman v. Millett.

IN the Mayor's and City of London Court, before Judge Shewell Cooper, on December 10th, Mr. G. Bowerman, importer, Ludgate Hill, E.C., sued Mr. J. Millett, Farringdon Avenue, E.C., radio apparatus dealer, for £12 10s., the price of ten loud speakers. Plaintiff stated that in May last year a case of 24 loud speakers imported from Germany was delivered to the defendant. He had only ordered 12, but as they were packed in cases of 24 the whole case was delivered, and it was arranged that the balance of 12 should be at witness's disposal. As he could not obtain these instruments, he sent in an invoice. Mr. Millett stated that the plaintiff had received the 12 loud speakers in question. The plaintiff had called on a number of occasions and taken them away. Witness took no receipt for the instruments received by the plaintiff as they were plaintiff's own property. Judge Shewell Cooper said there was a direct conflict of evidence between the parties, and it appeared that the plaintiff had taken away the loud speakers and forgotten all about the transaction. He gave judgment for the defendant, with costs.

The Work of the Electricity Commissioners.

The Fifth Annual Report.*

(*Concluded from page 949*).

Generating Stations and Main Transmission Lines.

The aggregate capacity of the generating plant for new stations and extensions of existing stations sanctioned by the Commissioners during the year 1924-25 amounted to approximately 480,000 kW. The rate of provision for meeting the growing demands upon electricity undertakings was thus fully maintained at the figure recorded for the previous year, notwithstanding the continuance of the industrial depression.

Of the 2,244,225 kW of generating plant sanctioned during the past five years, 426,683 kW, or approximately 19 per cent., was for new stations, and 1,817,543 kW or 81 per cent., for the purpose of extending or remodelling existing generating stations. The division of the total for the five years as between the various authorities was approximately as follows:—Local Authority Undertakers, 64.7 per cent.; Company Undertakers, 27.8 per cent.; and Railway and Tramway authorities and non-statutory undertakings, 7.5 per cent.

The capacity of the generating plant sanctioned does not represent a *net* addition to the plant capacity of the country, as in a number of instances the installation of the new plant involved the displacement of other equipment of an obsolete type.

During the year the Commissioners issued 12 consents (6 to authorised undertakers and 6 to non-statutory undertakings) in respect of the establishment of new generating stations, representing an initial installation of plant having a total rated capacity of 16,681 kW.

During the year consents to the extension of existing generating stations were given by the Commissioners to 86 authorised undertakers (92 consents), and 11 further consents were given in respect of the extension of stations owned by railway and tramway authorities and non-statutory undertakings. The sanctioned extensions represent, in aggregate, a plant capacity of approximately 463,200 kW, as compared with the figure of 423,000 kW for the preceding year, the division of the total as between the various authorities being approximately as follows:—Local Authority Undertakers, 299,600 kW; Company Undertakers, 90,600 kW; Railway and Tramway Authorities, 22,700 kW; and Non-statutory undertakings, 50,300 kW.

Under the provisions of the Act of 1919, the Commissioners prescribed or approved of current, frequency and pressure to be used at new private generating stations proposed to be established by seven owners.

The Commissioners dealt with a number of important applications for consent to the establishment of main transmission lines and issued formal consents under the Act of 1919 in respect of 47 applications. A number of the consents related to 33,000-volt transmission lines, and two consents related to 66,000-volt lines, the undertakers being the County of Durham Electric Power Supply Company and the North Wales Power Company, Ltd.

Special Orders.

At the commencement of the period covered by the report, 74 applications for Special Orders relating to the establishment or extension of distribution undertakings were under consideration by the Commissioners, and during the year 88 further applications were received. The Commissioners made Special Orders in respect of 66 of the applications before them. Of the remaining applications, 10 were refused and 7 were withdrawn, leaving 79 applications still under consideration at March 31st, 1925.

As many as 35 of the applications lodged during the year competed, with current or prior applications. Eleven inquiries affecting 17 applications were held by the Commissioners.

Rates (Northumberland) Clause.

During the course of the proceedings in connection with certain applications made by Local Authorities for Special Orders to authorise the supply of electricity, the Commissioners had occasion to consider representations made by large ratepayers, for the insertion of a clause known as the Northumberland or Winchester Clause which provides that on the expiration of a certain period after the commencement of supply, and at definite intervals thereafter, the undertakers shall reconsider and if necessary revise and maintain the scale of prices charged for electricity so that so far as reasonably practicable no contributions from the local rates will be required for defraying the expenses of the undertaking during the succeeding interval. An inquiry was made of all local authority undertakers whose Electric Lighting Orders embodied a clause of the kind in question, with the view of ascertaining their practical experience of the operation of the clause. It transpired that in the majority of cases recourse to the clause had proved unnecessary as the undertakings had been consistently self-supporting. In other cases, however, the undertakers intimated that the existence of the clause in their Order had proved detrimental to development and restrictive in negotiating with consumers. After a full review of all the circumstances, the Commissioners decided normally to disallow the clause when applied for, unless a good case for its inclusion was made out.

* H.M. Stationery Office; price 2s. 6d. net.

General Observations.

The Commissioners, in the interests of future applicants for Special Orders, point out that the rules made by the Commissioners in respect of such applications provide for the submission of a statement of the capital proposed to be expended in establishing the undertaking, and of a report by an electrical engineer on the proposed scheme. The omission to furnish information of the kind in question at the outset has constituted a cause of delay which could have been avoided. Again, adequate consideration has not always been given by the promoters to the possible sources of supply available. The Commissioners require the promoters, in the event of an economic supply proving to be available, to submit a revised engineering scheme based upon such supply. Where applications have related to extensive areas of supply, the Commissioners have found it necessary to ask for a revised scheme when it has appeared to them that the compulsory works proposed to be carried out within two years after the granting of statutory powers, were not adequate or commensurate with the extent and nature of the proposed area. Lastly, there is a tendency to lodge applications, in some instances for extensive schemes, without having previously arranged for the provision of the necessary capital; in such cases the Commissioners are necessarily precluded from proceeding.

Sanction to Borrowing by Local Authorities.

At the commencement of the period covered by the Report, 101 applications from local authorities for sanction to borrowing for electricity purposes were under consideration by the Commissioners, and during the year 596 further applications were received. Sanctions were issued in 562 cases. The total amount of the loans sanctioned during the year was £13,379,060, an increase of about 37 per cent. on the figure of £9,776,593 for the previous year. Plant accounted for £5,725,196 and mains and services for £5,183,942.

Unemployment Grants Committee.

During the year there was an increase (from 60 to 75 per cent.) in the proportion of the wages bill payable by the State in the case of approved schemes financed otherwise than by loan. The number of applications referred by the Committee to the Commissioners for their observations was 153, as compared with a total of 159 in the previous year. The majority of the applications related to schemes for the laying of mains, but several important applications were made in respect of generating plant extensions and alterations of systems of supply. Four schemes submitted by company undertakers were also of an important character, involving an estimated total expenditure of £249,000, chiefly for main transmission lines and distribution works.

Mutual Assistance: Bulk Supplies.

During the past year, further progress was made in regard to bulk supply developments. In the case of the supplies (233) taken from authorised undertakers, the bulk suppliers number 58 local authorities and 32 companies. Notwithstanding the steady progress made in the giving and taking of bulk supplies during the past five years, this class of business still represents a comparatively minor branch of electricity supply in this country. The majority of undertakers prefer to extend their generating stations up to the limit of the capacity of the sites, whether well-adapted or not for modern methods of generation. Little or no regard is given in many cases to the position that will arise when the limited extension, if approved, has achieved its immediate purpose and further provision becomes necessary to meet additional demands. In a number of cases it has appeared to the Commissioners that the ultimate interests of an undertaking would have been better served by the taking of a supply in bulk. It is apparent that accelerated progress under existing conditions is dependent upon the fuller co-operation of authorised undertakers generally.

In addition to 24 other approvals, the Commissioners made Orders permitting a supply of electricity in bulk being given by the Corporation of Edinburgh to the Lothians Electric Power Company, and by the Mersey Power Company, Ltd., to the North Wales Power Company, Ltd. They also approved of the Central Electric Supply Company, Ltd., and the Metropolitan Electric Supply Company, Ltd., and of the Central Electric Supply Company, Ltd., the Kensington and Knightsbridge Electric Lighting Company, Ltd., and the Notting Hill Electric Lighting Company, Ltd., entering into and carrying into effect agreements for their mutual assistance.

Alterations of Systems and/or Pressures.

The Commissioners issued 24 consents during the year to alterations in the declared system and/or pressure of the supply hitherto adopted by 23 different authorised undertakers. Further progress was achieved in the direction of the elimination of odd frequencies, seven of the consents being in respect of alterations to the standard frequency of 50 cycles per second from other existing frequencies. In most of the other instances the alterations were from d.c. to 50-cycle a.c. distribution.

Electric Lines and Works of the Postmaster-General.

A conference between representatives of the electricity supply industry and of the General Post Office was convened by the Commissioners in August, 1922, for the purpose of discussing various matters of joint interest. After further consultation with the General Post Office, the Commissioners, in August, 1923, received a communication from the Postmaster-General on the matters discussed at the conference, and a brief summary of the communication is given below.

On the question of the allocation of the cost of the necessary protection of Post Office lines erected subsequently to those of authorised undertakers, the Postmaster-General informed the Commissioners that although he was strictly entitled to recover from the undertakers the full cost of protection, it was the practice of the Post Office in such cases to bear (*a*) half the cost of guard wires or of an alternative such as the erection of insulated wires by the Post Office; (*b*) the whole cost of fuses and heat coils; and (*c*) the whole cost of inserting a layer of concrete between underground power plant and new Post Office plant where the separating distance was less than two inches.

The communication further stated that Parliament had recognised the danger inseparable from the presence of electricity power and supply undertakings (*sic*) on the public roads; had laid down, as a condition for the granting of statutory powers, that precautions must be taken for the safety of other users of the roads; had given specific protection against the injurious affection of telegraphs (including telephones); and had laid on the Board of Trade the duty (now exercisable by the Commissioners) of safeguarding the public; that the erection of guard wires or other protective devices in cases where telegraph or telephone plant was in proximity to the overhead lines of undertakers was essential for the safety of the public and might be regarded as a reasonable insurance by the undertakers against claims for damage to the telegraphs and telephones which might otherwise arise; and that the Postmaster-General regretted that he was unable to recommend to H.M. Treasury any further financial concessions.

With regard to the laying of Post Office mains in proximity to those of authorised undertakers, the Postmaster-General intimated that the Engineer-in-Chief of the Post Office had issued an instruction that the engineers of electricity supply undertakings should be consulted as to the position of their plant and should be informed of the probable date of laying Post Office plant.

Other questions arising in connection with the overhead line regulations of the Commissioners and of the Post Office, respectively, were also dealt with in the communication, and the technical considerations involved were left for further discussion. These matters are awaiting eventual settlement in connection with the revision by the Commissioners of their existing code of regulations for securing the safety of the public and ensuring a regular and efficient supply of electrical energy.

Supplies from Railway, &c., Generating Stations.

Under the provisions of Section 25 of the Electricity (Supply) Act, 1922, the Commissioners, during the year ending March 31st, 1925, issued consents to the undermentioned bodies in respect of the supplies indicated in each case:—

(i) *London and North-Eastern Railway Company.*—Consent was given to a supply of electricity in bulk from the generating station of the railway company to the Corporation of Harwich for the purposes of the undertaking authorised by the Harwich Corporation Electric Lighting Order, 1914.

(ii) *London County Council.*—Consent was given to a supply of electricity from the Greenwich tramway generating station of the London County Council to the London Electric Supply Corporation, Ltd.

Consents to Subscriptions to Associations.

During the year the Commissioners issued consents in respect of the payment of annual or other subscriptions to and/or expenses of attendance at meetings of the British Electrical Development Association (Inc.), the British Engineering Standards Association, the Incorporated Municipal Electrical Association, District Joint Industrial Councils and Joint Boards, electrical displays at Wembley and at the Ideal Home Exhibition, &c.

Advisory Committee on Methods of Charge, &c.

During the year the Commissioners had occasion to give further consideration to the general question of methods of charge and multi-part tariffs, and its bearing as a factor in securing a more extensive development in the use of electricity for domestic purposes. It appeared that an attempt should be made to frame a few model or standard methods of charge, with the view of its being made generally known to authorised undertakers that applications for approval of or for powers to charge by such methods would be favourably entertained in appropriate cases. By the adoption of recognised standard methods, it would only remain to fix the actual quantum (*e.g.*, the particular fixed charge and the particular unit charge in the case of a standard two-part tariff) on the merits of individual applications.

After consultation with the principal associations representative of the electricity supply industry, the Commissioners decided to appoint an Advisory Committee to consider and report upon the question.

Overhead Lines and Wayleaves.

The number of applications for consent to the erection of overhead lines was fully maintained, 162 applications being dealt with by the Commissioners during the year. At the date to which the report is made, the Minister had given his consent in respect of 155 of the applications.

The Commissioners dealt with 12 applications for consent to wayleaves. In the case of the Derbyshire and Nottinghamshire Electric Power Company, consent was given to wayleaves across certain lands in the parish of Morley, the annual rental being fixed by the Minister at 1s. for each 100 yards of cable laid underground; 10s. for each double pole which impeded ploughing operations; 5s. for each double pole which impeded the mowing of grass; and 3s. for each double pole in other cases. Similar conditions were granted to the Leicestershire and Warwickshire Electric Power Company, but in certain cases the annual rentals for double poles were fixed at 8s., 4s., and 2s., respectively, and 6d. for each stay. The North Metropolitan Electric Power Supply Company received consent to wayleaves across certain lands at the rate of 2s. 6d. per pole, and 1s. for each 100 yards of cable laid underground. The North Wales Power Company, Ltd., received consent to a wayleave across certain property at a rental of 2s. per pole.

Organisation and Staff of Electricity Commission.

The volume of work falling to be dealt with by the Commissioners showed a further increase during the year under review. On March 31st, 1925, the staff of the Electricity Commission numbered 54 in all.

At the beginning of the financial year the estimated net cost of administration for the year was £45,550; and the then outstanding liability to H.M. Exchequer in respect of interest on and repayment of advances made to meet the expenses of the Commissioners prior to April 1st, 1922, amounted to £23,450. Allowing for a reduction of £2,000 in the working balance, the total amount to be apportioned among authorised undertakers was therefore £67,000, and this estimate was approved by the Minister. The apportionments in respect of the estimate were made on authorised undertakers in June, 1924, the contributions by the electricity supply industry towards the expenses of the Commissioners for 1924-25, inclusive of repayment to H.M. Exchequer, involving a payment by each authorised undertaker concerned amounting to 3.7d. per 1,000 kWh sold.

The actual net expenditure on administration during 1924-25, including the special expenses incurred by the Commissioners in connection with the report on Standardisation of Frequency (£4,206), was £43,520, a net saving of £2,030 on the total estimate, due partly to the sustained increase in the number of applications for Special Orders. The liability of the Commissioners in respect of advances from H.M. Exchequer was finally discharged during the year.

In concluding the report, the Commissioners record, with regret, the retirement of their colleague, Mr. Harry Booth, O.B.E., from the office of Electricity Commissioner on January 24th, 1925, after five years of service in that capacity and after completing over 40 years in all in the public service.

Fifteen appendices and two maps are attached to the report.

London's Electricity Supply in 1923-24.

The L.C.C. Annual Report.

(*Concluded from page* 956.)

In our last issue we dealt with those sections of the report relating to the capacity, output and finances of municipal and company undertakings; in this part we deal mainly with charges to consumers, a subject which occupies twelve pages of the report and presents infinite variety.

No fewer than 22 methods of charging are in vogue and these methods are applied in various ways by different authorities. Generally, it may be said that there are four main methods of charging for electricity:—(i) The flat-rate system; (ii) the sliding-scale system, whereby the rate decreases as the consumption rises; (iii) the maximum demand system, by which the equivalent of so many hours' use of the maximum demand is charged for at a relatively high rate, with a smaller charge for further consumption; (iv) the "telephone" system, comprising a fixed annual or quarterly charge, based on the size and character of the installation or upon the rateable value of the premises, with a low "unit" rate for energy consumed. Other less common methods employed are:—(v) The two-rate

system, involving the use of a time switch, whereby energy consumed during certain hours is charged for at a lower rate than during the rest of the day; (vi) the prepayment-meter system; and (vii) the contract-tariff system whereby the charges are determined solely by the installation without regard to actual consumption. There are only two examples of the last system in London; these are Barnes, where the rate is based on the number and size of lamps, and Hammersmith, for power, in respect of 100 per cent. load factor devices.

It may be said at once that true comparisons between the rates charged by various undertakings are well-nigh impossible; the nearest approach to accuracy is made by comparing flat rates, and in this connection it is considered permissible to include the first steps of sliding scales, it being argued that proportionately few consumers ever reach the further steps. On this basis a table has been compiled showing the flat rate charges for lighting of 85 undertakings, or sections of undertakings where large companies make different charges in various parts of their areas. From the table it is seen that the upper and lower limits were 1s. per kWh (Leatherhead and Caterham (Urban Co.)), and 4d. per kWh (Battersea, Hampstead, Hendon, and St. Pancras). The average flat-rate of the 85 undertakings was 6.9d. per kWh. In the preceding year, although the maximum and minimum rates were the same, the average rate for 83 undertakings was 7.17d. per kWh, so that the latest figures show a decrease of 0.21d. per kWh in the average lighting charge. In the case of power charges a similar table has been prepared and 72 undertakings are set out in this. The highest rate was 7d. per kWh, representing the first step of sliding scales in force at Bromley (Kent), Chislehurst, Dorking (Edmundson's), Twickenham and Teddington, and Walton and Weybridge (Urban Co.). The lowest rate was 1d. per kWh (Hampstead and St. Pancras). The average rate for power charged by the 72 undertakings was 2.95d. per kWh. In 1922-23 the charges were bounded by the same limits, but the average was 3.6d. per kWh; thus the latest figures record a decrease of 0.65d. per kWh. In a similar statement in connection with flat-rate charges for heating and cooking, 85 undertakings are tabulated. In this case the maximum rate was 6d. per kWh (Dorking), the minimum rate 1d. per kWh (twelve undertakings), and the average rate 2.2d. per kWh (approx.). The average rate for the same number of undertakings in 1922-23 was 2.42d. per kWh. Therefore, assuming that these flat rates give some indication of the general tendency of prices, it will be seen that the average lighting rate was reduced by about 3 per cent., the power rate by 18 per cent., and the heating and cooking rate by 9 per cent.

The actual effect of the other systems dealt with cannot, of course, be gauged from the mere figures showing the basic and other charges instituted. In addition to varying their charges, many undertakings adopt special conditions, compliance with which secures to the consumer a lower rate. For instance, in Wimbledon energy for water heaters is charged for at approximately ¾d. per kWh, provided the total consumption for heating and cooking is not less than 150 kWh per quarter. Two or three undertakings allow power consumers to use a percentage of their power consumption for lighting purposes. The Brompton & Kensington Co. has instituted a lower lighting rate for private-house basements. Many authorities have special rates for institutions of various kinds, shop lighting, electric signs, &c.

Following this section is a table showing the assessments for the rating purposes of the London undertakings; this gives the rateable value of municipal undertakings as £135,409, and that of the company undertakings as £429,524, making a total of £564,863. The final part of the report proper gives the total number of kWh sold by each undertaking in 1913-14 and each year from 1917-18 to 1923-24. Complete figures for the extra-London companies are not available, but the total sales of the municipalities and the London companies are seen to have risen from 408,542,070 kWh in 1913-14 to 792,619,083 kWh in 1923-24.

A new feature of this report is an appendix which gives later figures for the company undertakings than those given in the body of the report, *i.e.*, for the year ended December 31st, 1924.

These figures may be briefly summarised as follows:—Plant capacity at the end of the year 452,480 kW generating and 98,431 kW transforming; maximum demand 344,057 kW; load factor, 21.4 per cent.; total energy generated, 659,407,609 kWh; total energy sold, 522,531,986 kWh; net capital expenditure, £28,968,474; total revenue, £6,624,761; working expenditure, £2,688,010; available for capital charges, £3,901,960; capital charges, £3,869,484. The last figure is incomplete.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

The Christmas Holidays.—The ELECTRICAL REVIEW for December 25th will appear one day in advance of the usual time of publication owing to the Christmas holidays. The attention of contributors and advertisers is therefore directed to the announcements to this effect published in our last issue, as by the time this notice is in the reader's hands the preparation of the next issue must be in a forward state.

The "Electrical Review" Index.—The Index to Vol. XCVII (for the half-year ending December 31st, 1925) will be published shortly, and we shall be glad to receive the names and addresses of those who require it (free of charge) for binding purposes or wish to retain it for reference. Application should be made as early as possible to the Publisher, 4, Ludgate Hill, E.C.4.

"The" Wireless Exhibition of 1926.—With reference to our several editorial comments regarding the undesirability of too many wireless trade exhibitions being organised for next year, we are pleased to be able to give publicity to an announcement received from the National Association of Radio Manufacturers and Traders.

That Association has concluded negotiations for the holding of a wireless exhibition in 1926, which will be open alike to members and non-members of N.A.R.M.A.T. Further statements regarding the matter will be issued from time to time.

The British Industries Fair.—In order that buyers may be afforded every possible facility, the Government has decided that holders of the official invitation cards may have their passports to England visaed without any charge being made. Invitations to visit the Fair are being issued to all firms abroad whose names are on the Department's index and to any other firms suggested by exhibitors. In addition, the British Government extends a general invitation to all overseas buyers to visit the Fair. Invitation cards may be obtained from the nearest British Consul or from the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

Lead.—Messrs. James Forster & Co. state that a further cut in the American price on December 8th of about 25s. per ton caused a further fall here. With a prospect of larger supplies from America in the near future, they are inclined to think that prices will go lower yet. The Board of Trade returns for November were:—Imports, 19,943; exports, 2,563; leaving for home consumption 17,380 tons.

Birmingham Electric Club.—At its annual meeting to-day the report for the 1925 session is to be presented by the committee. The total membership is now 213 as against 183 a year ago. The attendance at the club meetings varied from 41 to 136 and averaged 65 compared with 62 in the previous session.

The North-Western District Council.—The annual conference of authorised undertakers in the North-Western Area was held at the Manchester Town Hall on December 8th for the purpose of reviewing the work of the past year and electing employers' representatives for the District Joint Industrial Council (No. 3) and the District Joint Board of Employers and Staff Members. Mr. A. H. Banks, the employers' secretary, has sent us a statement showing the grouping of the undertakings and the names of re-elected representatives.

The International Glow Lamp Syndicate. — It is stated that the members of the International Glow Lamp Syndicate will meet at Berne in the near future to decide on the question of the standardisation of glow lamps throughout the world in order to simplify production and also possibly to reduce the sale prices. In this connection some further information has become available concerning the recent statements made by Dr. Meinhardt of the German Osram Company, to which reference was made in our issue of December 11th. It appears that the superstructure of the international glow-lamp agreement is formed by the Phoebus, A.G. für Industrielle Entwicklung des Beleuchtungs Wesen, which is the covering company of the whole organisation that has been established in Geneva, because Switzerland has not yet concerned itself with legislative measures restricting the activities of syndicates. In the countries represented by the syndicate, sales are independently regulated according to the turnover and the share of the country in the business. The other countries are common territories and for these allotments are arranged in a chosen year according to the sales of the interested glow lamp industries. It is, however, provided that makers who have obtained a special footing in definite markets shall not lose the advantages of their labours.

A South-Western Lighting Service Bureau.—On December 2nd a meeting was held in Cardiff to discuss the formation of a Lighting Service Bureau to serve the interests of the industry in the South-Western area. Many engineers representing supply authorities were present, in addition to representatives of the wholesalers and electrical contractors. A resolution expressing the desirability of starting a Bureau was carried unanimously, and a sub-committee of the various interests was formed in order to go fully into the details of the scheme.

Profits of German Electricity Undertakings. — The *Eletrische Betrieb*, in a recent issue, gave the results for the past financial year of 54 electricity supply undertakings in Germany, which showed an average dividend to the shareholders of 6.25 per cent., as compared with an average of only 4.3 per cent. for German industrial undertakings. Only seven of the 54 concerns failed to pay a dividend.

Trade Announcements.—MESSRS. FRANK A. SMITH, LTD., radio specialists, have opened new premises at 27, High Street, Stourbridge.

MR. F. WARREN, of the Radio Works, Dallow Road, Luton, has opened additional premises at 8, Gordon Street in that town.

MR. GARDINER, radio dealer, of Dumfries, has removed his business to 95, Friars' Vennel.

MR. C. BERNARD DAY, radio engineer, has commenced business at 10a, St. Andrew's Street, Bury St. Edmunds.

THE LIGHTING, HEATING & TRACTION SUPPLIES Co. has removed from 43 to 51, Doughty Street, W.C.1.

As some of their trade cards have been presented by unknown persons without authority, MESSRS. L. G. HAWKINS AND Co., LTD., of London and Glasgow, wish to inform the trade that they will only be responsible for goods supplied to them against their definite official order duly signed.

THE AUTO ELECTRICAL SERVICE Co. has opened a depôt at 519, Green Lane, Goodmayes, Ilford.

Book Notices. — "Electrical Engineering Problems." Part I. By John G. Pertsch. Pp. viii+213; figs. 100. London: McGraw-Hill Publishing Co., Ltd.—This volume contains problems on the fundamental relations in electrical and magnetic circuits and their application to d.c. machinery. Conversion and copper-wire tables, and also resistance computation constants are given in appendices.

"Circular of the U.S.A. Bureau of Standards No. 232," July, 1925; No. 276, August, 1925 (20 cents).

"Technologic Papers of the U.S.A. Bureau of Standards." Nos. 286 (10 cents), 288 (10 cents), and 289 (20 cents). June, 1925.

"Scientific Paper of the U.S.A. Bureau of Standards No. 508," June, 1925 (20 cents).

"Yallourn and the Associated State Electricity Schemes." Melbourne: *Australasian Electrical Times*. 6s., post free.

"Alternating-Current Circuits," by J. M. Briant, M.S., E.E., and J. A. Correll, M.S. Pp. xii+412; figs. 289. London: McGraw-Hill Publishing Co., Ltd. Price 20s. net.

Catalogues and Lists.—THE LONDON FACTORS & AGENTS, LTD., 38 and 39, Parliament Street, S.W.1.—A comprehensive catalogue of electrical material, accessories and appliances.

SIEMENS & ENGLISH ELECTRIC LAMP Co., LTD., 38 and 39, Upper Thames Street, E.C.4.—Catalogue No. 97, containing illustrated details of shades, bowls and reflectors; Leaflet No. 147, advertising "Siemens" neon lamps; and Leaflet No. 146, dealing with electric lamp outfits for decorative purposes.

THE ELECTRIC HEATING Co., George Street, Croydon.—An illustrated and priced booklet dealing with "Elect" irons and other domestic appliances.

MR. ALAN WRIGHT, Sentinel House, Southampton Road, W.C.1.—A pamphlet illustrating a number of "Inventum" appliances suitable for Christmas gifts. Priced.

MESSRS. FREDERICK BRABY & Co., LTD., Petershill Road, Glasgow.—A booklet advertising "Venteolite" galvanised sheets for ventilating purposes.

MESSRS. ERSKINE, HEAP & Co., LTD., Room 607, Australia House, Strand, W.C.2.—Pamphlet TCC.1, containing illustrated details of the company's truck type cubicle switchgear.

N-K, LTD., 111, Great Portland Street, W.1.—An illustrated pamphlet advertising "Daenite" electric signs.

THE BRITISH THOMSON-HOUSTON Co., LTD., Mazda House, Newman Street, New Oxford Street, W.1.—An adhesive coloured paper cut-out advertising "Mazda" lamps.

MESSRS. A. J. STEVENS & Co. (1914), LTD., Walsall Street, Wolverhampton.—A well-produced coloured showcard depicting one of the company's cabinet radio receivers.

MESSRS. R. JENKINS & Co., LTD., Rotherham.—A collection of illustrations of a number of welded products produced by the company.

PHILIPS LAMPS, LTD., 60, Wilson Street, Finsbury Square, E.C.2.—A folder advertising the "Savelite," an a.c. incandescent lamp of very low wattage.

THE GENERAL ELECTRIC Co., LTD., Magnet House, Kingsway, W.C.2.—A mailing card bearing illustrations and prices of "Gecophone" receiving sets and headphones. Also the December "Osram Bulletin," containing notes and news of "Osram" lamps and valves.

FULLER'S UNITED ELECTRIC WORKS, LTD., Woodland Works, Chadwell Heath, Essex.—An illustrated publication treating of the company's train-lighting batteries.

THE LANCASHIRE DYNAMO & MOTOR Co., LTD., Trafford Park, Manchester.—Descriptive List 465, containing full, illustrated particulars of "Crypto" constant-potential battery-charging equipment—a.c. and d.c. Priced.

THE MARCONIPHONE Co., LTD., 210-212, Tottenham Court Road, W.1.—Publications Nos. 364F and 438, dealing with "Marconiphone" and "Sterling" radio receivers, accessories, and components. Illustrated and priced.

THE LODGE FITTINGS Co., LTD., 57, Albert Road, Aston, Birmingham.—An illustrated and priced pamphlet dealing with "Classic" desk, &c., lighting fittings.

THE MIRRLEES WATSON Co., LTD., Scotland Street, Glasgow.—Publication No. Pu.10, containing an illustrated description of a surface condensing plant recently installed at a spinning mill at Ballymena, Ireland. Also Pamphlet No. S.515, describing the company's feed water evaporators.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—December stock list of motors and dynamos.

METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester.—Catalogue (Section M), dealing with domestic electrical appliances. The range covered is a very wide one, and full details, illustrations, and prices are given. Also two smaller booklets, entitled "Cosmos Home Helps" and "Home Helps for Christmas," containing details of domestic appliances.

THE RAY ENGINEERING Co., LTD., Frogmore Street, Bristol.—Publication B.S.1, containing illustrated details and prices of battery switchboards.

Bankruptcy Proceedings.—W. A. A. C. ROBINSON, 10, Carnaby Street, Golden Square, W., electrical engineer.—The application of this bankrupt for an order of discharge came before Mr. Registrar Mellor on December 8th at the London Bankruptcy Court. The Official Receiver reported that the applicant failed last July with ranking liabilities of £443 and assets which had realised £9. He was employed as a charge engineer at a salary of £350 p.a., but resigned the post owing to his financial difficulties. The discharge was suspended for two years on statutory grounds.

E. H. NEWMAN (trading as Newman & Co.), radio and electrical engineer, Shepherd's Bush Green, W.—The first meeting of creditors was held on December 10th at the London Bankruptcy Court, when the Official Receiver reported that the liabilities were roughly estimated at £700 and the assets were valued at £20. The debtor had stated in the course of his preliminary examination that he had carried on the above business in part ownership with his wife. During the war he served as a wireless operator with the Naval Forces. In September, 1923, he obtained the post of salesman to a radio company, and in June of the following year he assisted in the formation of the Radio Electrical Co., Ltd., of which he was appointed the managing director. But it was not a success and it had gone into voluntary liquidation. During the period of his directorship he was also acting as manager of a works controlled by the liquidator of another radio company, and in January last, in partnership with his wife, he began the business of Newman & Co. That business mainly consisted of employing travellers on a commission basis for the purpose of selling radio accessories to shops and dealers, and it had probably never been a success in consequence of heavy overhead expenses and lack of capital. Recently his credit had been stopped, and creditors had taken legal proceedings against him. He obtained several adjournments of the petition in bankruptcy in the hope of his being able to form a company to take over his assets and his liabilities, but nothing definite had yet matured. In the absence of any resolution the estate remained in the hands of the Official Receiver.

JOHN MUNRO and JOHN MUNRO & Co., electrical engineers and plumbers, 45, York Place, Edinburgh.—A dividend will be payable on January 21st at the office of Messrs. W. J. A. Drummond & Lessels, 10, Stafford Street, Edinburgh.

J. BRODIE, electrical engineer, 59, High Street, Dunfermline.—A meeting to elect a Trustee and Commissioner was to be held yesterday, December 17th, at the D.C.I. Rooms, Bonnar Street, Dunfermline. Agent, Mr. J. W. Sterling, 77, Queen Anne Street, Dunfermline.

T. BARTON, electrical engineer, The Electric Works, Ainsworth Street, Blackburn.—Last day for proofs for dividend, December 24th. Trustee, Mr. A. T. Eaves, 47, Mosley Street, Manchester.

J. MITCHELL and F. MITCHELL (F. Mitchell & Co.), electrical engineers, 97, Stockport Road, Ardwick, and 58, Ashton Old Road, Openshaw, Manchester.—First and final dividend of 4s. 4½d. in the £, payable at the Official Receiver's offices, Byrom Street, Manchester.

J. R. PATTISON, electrical supplies factor, 15, Goldsmith Street, Nottingham.—First and final dividend of 1s. 7¾d. in the £, payable December 18th, at the Official Receiver's offices, 4, Castle Place, Nottingham.

H. L. WOOD, electrical engineer, late of Elm Grove, Southsea.—Receiving order made December 1st, on debtor's own petition.

E. O. HENSTOCK, electrical engineer, 21, Old Road, Brampton, Chesterfield.—First meeting, December 18th, at the Official Receiver's offices, 4, Castle Place, Nottingham; public examination, January 15th, at the County Court, Chesterfield.

W. R. GRIGSBY (Wenham Lighting Corporation), electrical factor, late of 184, Gray's Inn Road, W.C.—Last day for proofs for dividend, December 28th. Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.

M. D. ROSENBLOOM (D. Rose & Co.), electrical engineer, 25, Osborn Street, E.—Last day for proofs for dividend, December 28th. Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.

Company Liquidations.—MORGAN WESTON, LTD., 38, Great Russell Street, W.C.1, radio and electrical dealers.—A meeting of creditors was held recently, at the offices of Messrs. Oscar Berry & Co, C.A. A statement of affairs was presented which showed liabilities of £1,353, all due to unsecured trade creditors. The assets were estimated at £462, leaving a deficiency of £891. It was reported that the company was incorporated on October 14th, 1924, with a nominal capital of £500, principally to carry on business in radio, electrical, and similar goods, and for that purpose an agreement was entered into with Nancy Cope to purchase a business carried on by her at Houndsditch, and in consideration she received 498 fully paid ordinary shares in the company. The first directors were N. Cope and V. E. Cope. Mr. V. E. Cope was appointed managing director at a salary of £500. In December, 1924, the company granted a debenture for £400 to Messrs. Merchants & Agencies, Ltd., in consideration for goods supplied to the company. Further financial assistance was given by

Merchants & Agencies, Ltd., in June this year, and an agreement was entered into whereby Merchants & Agencies, Ltd., secured the right to nominate a director of the company, which undertook to buy all high-pressure batteries from Merchants and Agencies, Ltd. In June Mr. V. E. Cope vacated his position on the board, and Mr. W. H. Harper and Mr. V. Richards were appointed directors. In July the capital was increased to £2,000, and 1,500 additional shares of £1 each were issued to Mr. Harper as nominee of Merchants and Agencies, Ltd., and the amount owing to that company was thereby reduced by £1,500. As the result of pressure from the two largest creditors the company went into voluntary liquidation on November 23rd. It was stated that the books of the company were in a very unsatisfactory condition, and it had been difficult therefore to gauge the real financial position. The figures placed before the company on November 23rd last showed a trading loss of over £400. No resolutions were passed, and the matter remains in the hands of Mr. Oscar Berry as liquidator.

The creditors include :—

"Ahems" Werkstatten (Berlin) £665; Merchants & Agencies, Ltd. £549.

ENGINEERING INDUSTRY, LTD.—A meeting of members is called for January 14th at Sardinia House, Sardinia Street, Kingsway, W.C., to hear an account of the winding up from the liquidator, Mr. H. N. Hare.

Private Arrangements. — W. W. SYMPER and D. J. EVERSHED, trading as Symper & Evershed, 22-24, Greenhill Parade, Harrow, electrical and radio contractors.—According to a circular issued by the British Traders' Association, a meeting of creditors was held on November 13th, but no resolutions were passed. Subsequently, however, it was possible, by consent of the largest creditors, for the debtors to execute a deed of assignment to Mr. W. Osborne on December 2nd. A revised statement of affairs had been prepared, showing that the deficiency was more than explained by the writing down of the assets. The business was commenced by Mr. Symper in 1918 on borrowed capital, and two years afterwards Mr. Evershed joined him, introducing £500. Certain accounts were prepared up to May, 1924, which disclosed a substantial profit. From June, 1924, to October 31st, 1925, there was a small profit, but after allowing for the joint drawing of the debtors, a loss was made. The statement of affairs attached to the circular shows liabilities of £2,647, and net assets of £1,779, leaving a deficiency of £868. By direction of the largest creditors, arrangements will be made to continue the business for a few weeks, so that either partner can make endeavours to introduce a buyer. The committee acting with the trustee comprises a representative of Messrs. Falk, Stadelmann & Co., Ltd., Mr. S. F. Thomas (General Electric Co., Ltd.), Mr. Martin (Vulcan Electric Co., Ltd.), and Mr. Lightstone (Ever Ready Co. (Gt. Britain), Ltd.). The following are creditors :—

	£		£
Cable Accessories Co., Ltd. ...	40	Metropolitan-Vickers Electrical Co., Ltd.	90
Crabtree, J. A., & Co.	72	Marconiphone Co., Ltd.	25
Dickson & Sons, Ltd.	24	Mico Light Co., Ltd.	20
Ever-Ready Co., Ltd.	61	Smith, J. & W. B., Ltd. ...	90
Eastick, J. J., & Son	32	Swedish General Electric, Ltd. ...	20
Electrical Appliances Co., Ltd....	82	Vulcan Electro-Mechanical Co. ...	301
Falk, Stadelmann & Co., Ltd. ...	242	Wandsworth Electrical Mfg. Co.	20
General Electric Co., Ltd. ...	385		

The Engineering Industry and Foreign Competition.—*The Times* states that arrangements have been made for the adjourned conference between the Minister of Labour and representatives of the Engineering Employers' Federation and the engineering unions, on the question of foreign competition, to be held on December 21st. The employers and the unions have joined in a request to the Government to take steps under the Peace Treaty or otherwise to secure an arrangement whereby the working hours of competitor nations on the Continent may be brought into reasonable relation with the working week in this country. The Minister of Labour at the last interview promised to consider the points raised, and it is expected that on Monday next he will give the reply of the Government.

The Newcastle Supply Co.'s New Premises.—Much interest has been aroused by the building activities lately begun on the site of the old Turkish Baths, at the corner of Pilgrim Street and New Market Street, Newcastle-upon-Tyne. The building, which is to be ready for occupation in the autumn of 1927, is destined to be the northern headquarters of the electrical industry, and has become a necessity in view of the developments in recent years in the business of the Newcastle-upon-Tyne Electric Supply Company, Ltd., and its associated companies. This group is at present housed in five different places in Newcastle, having completely outgrown its registered offices in Hood Street, into which it moved in 1904. The concentration of the staff in one building will ensure increased efficiency and economies in working, and in the administration of the large area throughout which the company now supplies electricity. In addition to the staff of the supply companies, others will also be accommodated in the building. Messrs. Merz & McLellan, the consulting engineers to the companies, have arranged to occupy a portion of the new building, and any further space in the building which may be available will, in all probability, be occupied by electrical manufacturers or others concerned in the industry. Carliol House, as the new block is to be called, may in effect, therefore, become the main headquarters of the electrical industry in the North of England. The building has been designed by Mr. L. J. Couves, Newcastle-upon-Tyne, in conjunction with Sir John Burnet & Partners, of London. Mr. Couves made a special journey to the United States for the purpose of studying the most-up-to-date methods of planning and equipping large office buildings. The site chosen—which is a commanding one in the business centre of the city—has a ground area of 28,000 sq. ft. and a frontage in New Market Street of 432 ft. The building over about one half of the site will consist of eight floors, and, on the remainder, nine floors including the basements will be erected. There will be two entrances; one in New Market Street, and the other at the corner of Pilgrim Street and New Market Street. The latter will open into a

The Newcastle Supply Co.'s New Premises.

rotunda or circular hall, which will form part of the showrooms. These showrooms, which will be a special feature, will provide ample space for consumers to see electrical appliances in actual use. The lighting arrangements will be of the most modern type. A well-arranged basement on the eastern half of the premises will provide for the central heating and vacuum cleaning plants. Central heating will be provided by means of a low-pressure hot water system, which is to be heated electrically. The vacuum cleaning plant will be wholly electrical. The New Market Street entrance will give access, through an imposing hall, to a well-lighted staircase with four high-speed elevators to the offices above. Each floor will be divided into suites of offices, which have been specially planned to make for efficient working. The contractors carrying out the erection of the building are Messrs. Stephen Easten, Ltd., Milburn House, Newcastle-upon-Tyne.

New French Company.—La Société Nerka is the name of a new company which has lately been formed in Paris (21, Rue de Peletier) with a capital of 400,000 fr., to manufacture "Nerka" sparking plugs for motor vehicles.

Clock Electrification.—The clock with four dials each 26 ft. in diameter, in the tower of the Singer Buildings at Clydebank, Glasgow, is claimed to be the largest in the British Empire, and it is interesting to note that this clock has succumbed at last to modern methods, and the mechanical movement is being replaced by an electric time-keeper. A "waiting-train" movement similar to that driving the Liver Clock at Liverpool is being fixed by the patentees—Messrs. Gent & Co., Ltd., Leicester—the order having been received through their Scottish agents, Messrs. Edward & Son, Ltd., Glasgow.

French Foreign Electrical Trade.—The appended table shows the value of the French imports and exports of electrical machinery and apparatus during the seven months ended with July last, as compared with the corresponding period of 1924 :—

	Imports. January to July.		*Exports.* January to July.	
	1925.	1924.	1925.	1924.
	1,000 fr.	1,000 fr.	1,000 fr.	1,000 fr.
Electrical porcelain parts, insulators, &c.	1,979	6,051	8,295	8,869
Incandescent lamps ...	30,518	26,660	19,806	16,120
Dynamos and motors ...	31,127	31,160	36,108	33,991
Electrical and electro-chemical apparatus ...	30,487	31,774	95,442	117,339
Dynamo and electric motor parts	85	241	28	158
Insulated wires and cables	4,027	1,761	10,630	21,714
Armatures and electrical parts	9,711	9,716	14,448	13,651
Accumulators and parts ..	3,315	1,866	5,835	3,146
Dry batteries	58	66	1,271	1,546
Totals (1,000 fr.) ...	111,307	109,295	191,863	216,554

Fire.—The fire that recently occurred at the G.E.C. conduit works (The Oriental Tube Co., Ltd., West Bromwich) will not affect the delivery service of the General Electric Co., Ltd.

Copper, Lead and Rubber Prices.—Messrs. F. Smith and Co. report, December 15th :—Copper (electrolytic), £65 10s., 15s. dec.; ditto, ditto sheets, no change; ditto, ditto wire rods, £75 10s., 15s. dec.; ditto, ditto, h.c. wire, 9¼d., 1/16d. dec.

Messrs. James & Shakespeare report, December 15th :—Copper bars (best selected), sheet and rod, £90, £2 dec.; English pig lead, £35 5s., 15s. dec.

Messrs. Edward Till & Co. report, December 15th :—India-rubber, Para, fine, 4s. 5d., 1d. dec.

The Electricians' Wage Claim.—The apparently quiescent question of wages in the electricity supply industry was carried a stage further on December 9th. It will be remembered that a claim for an extra 10s. a week was put forward some months ago, and the men then resolved by ballot to take strike action if a satisfactory reply was not made to their claim. On December 9th it was decided to form a joint appeal board consisting of six representatives of each party, with an independent chairman; Mr. C. P. Sparks was unanimously elected to the position. The decision of this board is to be accepted by the parties to the claim, and it is stated that the first meeting will be held after Christmas.

E.D.A. Activities.—We are pleased to learn that the British Electrical Development Association is again to arrange a display of electricity in the home at next year's Ideal Home Exhibition at Olympia (March 2nd to 27th). The Association's exhibit at Olympia last March proved one of the greatest attractions and no fewer than 17,000 people paid a visit to the "Electric House."

Chinese Notes.—*The Chinese Economic Bulletin* states that the supply of electricity in Hankow, with the exception of the foreign concessions, is in the hands of the Hankow Waterworks & Electric Light Co., Ltd. The demand for electricity has grown rapidly and last year the company extended the supply to Hanyang across the Han River.

The authorities in Nanking, Kiangsu province, are building a radio station to communicate directly with Tientsin and Mukden

The Shantung authorities are installing a long-distance telephone system "to facilitate the work of bandit suppression."

The radio station at Yunnanfu, Yunnan province, is now open for public business.

The Shansi authorities have decided to construct a radio station at Linfeng (formerly Pingyangfu).

Coloured Decorative Lamps.—THE GENERAL ELECTRIC CO., LTD., has issued a pamphlet containing illustrations in colour of the huge signs erected by Messrs. Lewis at their Birmingham, Liverpool and Manchester establishments. These show very effectively the results obtained by the use of "Osram" colour-sprayed lamps.

Dissolution of Partnership.—VLASTO, CLARK & WATSON, electrical engineers, London Road Bridge, Stockton Heath, Cheshire.—Messrs. I. Vlasto, T. Clark, and W. Watson have dissolved partnership. Messrs. Vlasto and Clark will attend to debts and continue the business.

The Hackney Showrooms.—At a meeting of the Hackney and Stoke Newington Chamber of Commerce, last week, Mr. A. C. Bostell, A.M.I.E.E., sales manager of the Hackney electricity undertaking, introduced a scheme whereby the four empty showcases in the Lecture Hall of the undertaking are to be allotted in turn to members of the Chamber of Commerce, who will dress them and maintain them for one month. The lighting will be supplied free. The shopkeepers will pay an entrance fee, and three prizes will be awarded by public ballot. A prize will also be awarded to the person who accurately guesses the total number of votes recorded. Sir Herbert Ormond, J.P., offered a challenge cup for the best dressed case of the year. The scheme was adopted and a committee formed to arrange details. Mr. L. L. Robinson, borough electrical engineer, said that the showrooms and demonstration halls had been successful beyond their expectations; each day from eighty to one hundred people visited them, and on Saturday evening the number often reached a thousand. Already the sales were up 400 per cent.

The D.O.T. Commended.—In the course of a speech which he delivered at a dinner attended by the directors and sales representatives of Agricultural & General Engineers, Ltd., the chairman of the company (Mr. G. E. Rowland) paid a tribute to the Department of Overseas Trade. He urged sales representatives to direct their attention particularly to export trade and advised them to avail themselves of the services of the D.O.T. He said that he was surprised at the organisation of the Department; it was in a position to give a great deal of information to those who approached it.

A German Osram Lamp Loan. — The German newspapers state that the Osram Co. has concluded a loan of 5,000,000 dollars, with a currency of 25 years, with the Amsterdam Bank and other Dutch institutions, the Stockholm Enskilda Bank, and Lazard Bros., of London. The rate of interest is 7 per cent., and the loan is said to be guaranteed by the Berlin A.E.G. and the Siemens & Halske Co. Apart from the recent Berlin municipal electricity loan, the new loan is the first to be raised in the European market. The proceeds are intended for further improving the works of the company and for the establishment of a new glass factory.

The Canadian Radio Industry.—In the course of a note upon trade conditions in Canada, *Reuter's Trade Service* (Ottawa) says that Canadian manufacturers of amateur radio equipment are enjoying unprecedented prosperity, and at least one large firm has been forced to decline to accept any further orders until after the New Year.

Local Exhibition.—BLACKPOOL.—The Electricity Department has organised an electrical exhibition at the Winter Gardens, where a special display has been made of electrical bread-baking devices. Each member of the trade in the district has received an invitation to inspect the new apparatus.

Calendars, Diaries, &c.—In its calendar for 1926 the NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO. retains the black and gold style which has distinguished its past calendars. Weekly date slips are provided and each of these has a calendar for the current month at its foot.

MESSRS. ARTHURS, Charing Cross Road, W.C., have placed a humorous drawing (a "doggy" cat) on their 1926 calendar, of which we have received a copy.

From Mr. CHARLES SELZ, of 83, George Street, Baker Street, London, W.1, we have received a small pocket diary for 1926 with season ticket pocket, &c.

MESSRS. MATHER BROS., of 36, Farringdon Street, London, E.C.4. have sent us a wall calendar for 1926 with monthly slips and a date indicator.

MESSRS. FRANCIS POLDEN & CO., LTD., have sent us a useful wall calendar with monthly slips and a date-marking device.

The calendar received from the HART ACCUMULATOR CO., LTD., has extra large monthly sheets with 1¾-in. figuring which makes it suitable for the wall of a large office or shop. The company has also sent us, as usual, a desk blotting pad, each sheet of which bears a calendar for the year.

MR. L. W. FOOTE, of 30, Charles Street, Cardiff, has issued a wall calendar with monthly slips fixed below a reproduction of a charming water-colour "Flowers of the Sea."

The very neat and serviceable pocket diary of MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham, which has been our constant companion during 1925 because of its convenient space arrangement, will shortly give place to the 1926 one just received.

MESSRS. L. MCMICHAEL, LTD., have sent us an ash-tray with a match holder (or it may be a candlestick) in glazed earthenware. The match holder is a reproduction of one of the company's h.f. plug-in transformers.

MESSRS. PRITCHETT & GOLD & E. P. S. Co., LTD., of 50, Grosvenor Gardens, S.W.1, are sending out as a Christmas souvenir a large desk ash tray moulded in "Dagenite," the special composition used in the manufacture of containers for the company's portable batteries. Trade readers who wish to receive one of these trays are invited to apply to the company.

The "Tungstone" Accumulator.—We have received particulars of a new lead storage battery, of British design and manufacture, known as the "Tungstone" accumulator, in which the grids are made and pasted wholly by machinery. The pure lead grids are die-cast in small sections, which are joined together by a small proportion of antimonial lead fed under pressure into recesses between the sections. It is claimed that, thanks to the greater volume of pure lead present in the battery, the Tungstone plate has a higher amperage capacity and lower weight, together with longer life, than any other type of plate. Various patterns are made, for car starting, lighting, and ignition, for the high-pressure batteries of wireless apparatus, &c. The distributors are the Tungstone Accumulator Co., Ltd., of 3, St. Bride's House, Salisbury Square, E.C.4.

Social Events. — The annual dinner of the staff of the Osram-G.E.C. Lamp Works and the M.O. Valve Works (General Electric Co., Ltd.), was held at the Café Royal on December 12th, under the chairmanship of Mr. Chris. Wilson. After an excellent repast and the toast of the King, the chairman offered Sir Hugo Hirst, Bart., the congratulations of those present upon the honour conferred upon him by the King; he said that they felt that it was an honour done to them all. Mr. J. J. Gracie, proposing the toast of "The G.E.C.," said that the most remarkable thing about the company had been its rapid rise from small beginnings to a position of great importance. Two reasons for its growth had been its adaptability to needs as they arose, and the way in which the production and sales sides worked together as a unit.

Sir Hugo Hirst, in reply, spoke of the efforts which had been made to secure good conditions for the staff. He also said that the directors had been through the necessary experience and knew exactly what they should do. The depreciation of foreign currencies had rendered it necessary to seek international agreements to secure the safety of the company. Sir Hugo said that the country was still in an unhappy state; a very large organisation had just found it necessary to write down its capital and close certain branches, and he feared that others might follow suit with consequent unemployment and reduced purchasing power. The G.E.C. benefited by the diversity of its products. Dealing with the question of wages, the speaker said that the high rates paid in sheltered industries had led to discontent among skilled workers. Unless conditions were brought into a sane and sound condition we should be overwhelmed by foreign competition. He hoped, however, that things would turn out well and that electricity would save the country.

Mr. G. Cheliotti, in a humorous speech, proposed the toast of "The Visitors," and referred to the joint efforts of the works and sales staffs which had resulted in record sales of the company's lamps and valves.

Mr. F. Crawford, manager of the Liverpool branch, replied —partly in verse—and Mr. J. Y. Fletcher followed. The latter, referring to the fact that he was to be the next chairman of the Electric Lamp Manufacturers' Association, said that he hoped the works would soon be better represented on that body. With regard to the company's output, he said that export trade was of vital importance; they hoped soon to reach the position when one out of each pair of lamps produced would be sent abroad. In this connection he referred to international agreements, and said that he hoped that soon the General Patent and Business Development Association—"the

Locarno on the lamp industry "—would soon be functioning. After a great deal of negotiation, British and Continental lamp makers had reached some measure of agreement and since the end of 1924 the arrangement had worked fairly satisfactorily. They were not so advanced as regarded valves, but he hoped that a similar agreement would eventually be made in this respect. The British makers would, however, first have to secure a larger share of the business, which was undoubtedly enormous.

Mr. H. Williams proposed the health of the chairman, and Mr. Wilson responded.

Music was provided during dinner by the Hamilton Orchestra, and a concert was given by Messrs. G. Piper, J. Warren, G. Ceci, G. O'Hagan, and Jock Walker and Miss Dorrie Dene.

Henley's Dramatic Club is to be heartily congratulated on the excellence of its presentation of "Nothing but the Truth" (James Montgomery's comedy) at King George's Hall, Caroline Place, W., on Saturday evening last. Mr. H. Stanley as the New York stockbroker, Mr. A. V. Burnett as Bob Bennett, who underwent the ordeal of speaking the absolute truth for twenty-four hours, and Mr. F. J. Bettley as the Rev. Dr. Doran, played important parts in such a manner as to bring credit to themselves and to the Club. Mirth and merriment were well sustained throughout.

The third annual carnival dance of the Cardiff branch of the Magnet Club (the Social Club of the General Electric Co., Ltd.), was held in the Whitehall Rooms, Park Hotel, Cardiff, on Friday, December 19th. A considerable number of the staff with friends and members of other electrical undertakings in the district attended, there being about 130 present. The special lighting and dimming effects were much appreciated.

On Friday last the staff and employés of the Airedale Electrical & Manufacturing Co., Ltd., held their annual whist drive and dance at the Parade Café, Bradford. About 80 persons took part.

Spanish Railway Electrification Contract.—The Sociedad Iberica de Electricidad, of Madrid, the Spanish branch of the A.E.G., is reported to have secured the contract for the electrification of the railway between Bilbao and Las Arenas.

Our Foreign Trade.—NOVEMBER FIGURES.—The Board of Trade returns for November show the following values of electrical imports and exports:—

	Nov., 1925. £	Inc. or dec. £	11 months, 1925. £
Exports.—			
Electrical goods and apparatus	868,865	− 51,985	+1,498,413
Machinery	3,940,718	−335,216	+3,790,577
Electrical machinery	395,344	− 95,017	+ 420,305
Imports.—			
Electrical goods and apparatus	425,648	+ 40,000	990,029
Machinery	891,910	+ 91,768	+1,231,816
Electrical machinery	78,600	+ 6,904	+ 45,788
Re-exports.—			
Electrical goods and apparatus	13,568	+ 3,509	+ 61,093
Machinery	119,811	+ 11,797	+ 250,689
Electrical machinery	7,762	− 680	− 22,759

Accrington Votes for British Cable.—At Accrington Town Council meeting last week there was another long discussion as to whether British or foreign tenders for electric cables should be accepted. The Electricity Committee recommended a contract with Messrs. W. T. Glover & Co., who were willing to offer favourable terms for two years subject to wages and lead and copper prices. Alderman Higham (chairman) said the Committee was satisfied that the Continental product was not equal in quality to the British. They would probably be paying 12½ per cent. more in price, but they would get a better article. Mr. Watson (vice-chairman) said the Committee passed the recommendation by eight votes to three, and they were assured by experts that the British cable was superior. The exact figures were:—1,000 yards of foreign cable, £504; Glover's cable, £596 12s. 6d. If they sent the order abroad they would do an injustice to the British working man, who received a higher wage than the Belgian workmen. Mr. Aspden called attention to the British firm's profits, and asked how it could appeal to the public to buy its cables in face of those facts. If electrical undertakings were firm for three or six months he thought British prices would come down. Mr. Constantine moved the minute back, and said he was not convinced that the foreign cable was inferior. If they passed the minute they would be doing an injustice to ratepayers. If the order went elsewhere it would only add to the shareholders' profits. Mr. A. Wilkinson seconded, and said it was the duty of the Council to accept the lowest tender. Eventually the Committee's recommendation was carried, there being only seven votes for the amendment.

Hydro-Electric Development in Malaya.—The Kuala Lumpur correspondent of the *Financial Times* reports that on December 12th Sir Montague Barlow, on behalf of Sir W. G. Armstrong Whitworth & Co., Ltd., signed the Perak hydro-electric agreement in the presence of the British Resident and the Sultan of Perak. The agreement has been under discussion for several months past following upon a scheme for developing the hydro-electric possibilities of the Perak River submitted by Mr. F. Bolton, who spent over a year prospecting the river on behalf of Sir W. G. Armstrong, Whitworth & Co. Mr. Bolton estimated that a capital of about £2,750,000 would be required to enable the power generated to be sold at a cheap rate. The power will be applied principally in the development of the Kinta Valley and neighbouring tinfields situated in the same State. The company has secured a guarantee under the Trade Facilities Acts to the extent of £1,250,000.

Lighting and Power Notes.

Beckenham.—LOAN.—The Urban District Council has applied to the Electricity Commissioners for sanction to a loan of £10,000 to meet excess expenditure of about £6,000, and to provide for further extensions.

Bristol.—LOAN.—The Electricity Committee has decided to apply for sanction to a loan of £140,000 for mains extensions.

Burnley.—ELECTRICITY SUPPLY.—The Town Council, on December 2nd, decided that it could not agree with the opinion expressed by the Mid-Lancs. Electricity District Board and the Electricity Commissioners to the effect that it should take a bulk supply of electricity from the Lancashire Electric Power Co. rather than proceed with its application for sanction to extend its present station, and decided that the Commissioners should be informed that the Corporation was not prepared to take a bulk supply or to withdraw its application, and that all necessary steps should be taken to extend the Burnley station.

Bury.—ELECTRICITY EXTENSIONS.—The Town Council is applying for sanction to the borrowing of £16,000 for the erection of cooling towers at the Chamber Hall station, £25,000 for mains, and £5,000 for a sub-station.

Canada. — HYDRO-ELECTRIC DEVELOPMENT. — The Toronto correspondent of *The Times* reports that a company headed by Sir Herbert Holt has acquired the right to develop one million h.p. on the St. Lawrence River near the Ontario boundary. In the case of a deficiency in Ontario Sir Herbert Holt is willing to sell 300,000 h.p. to the Ontario Hydro-Electric Commission. It is expected that the Holt development scheme will be completed in the next two years.

Cheltenham.—NEW PLANT.—The Electricity Committee is to install a new boiler, &c., at the generating station at a cost of £11,450.

Continental.—RUSSIA.—In connection with the question of protecting the city of Leningrad against sea floods, a special inter-departmental Commission was appointed some time ago to study the different proposals. The Commission has examined three different schemes, one of them planning high sea dams in the entrance from the Gulf of Finland into the Neva near the Isle of Kotlin, the second suggesting dams in the middle section of the Bay, and the third, erecting dams further up the Neva along the shore line of the Bay, and the seaside line of the isles in the estuary. The second and third schemes embody a proposal to erect a dam on the rapids of the Neva, 18 miles up from Leningrad. This dam would be utilised in connection with a hydro-electric plant working at a head of about 13 feet and yielding approximately 60,000 h.p.

The Schatur State power station, which is situated 130 versts from Moscow, was formally opened on December 6th by M. Trotsky. The station, which has a capacity of 65,000 h.p., burns turf fuel, and will supply power for part of the industrial undertakings in Moscow and the surrounding district.—*Reuter* (Moscow).

AUSTRIA. — Work has recently commenced on the establishment of a hyro-electric plant for the supply of electricity to the town of Trieste. For this purpose a dam is to be constructed on the River Reka; the water will be conveyed by a canal 11¼ miles in length to a large storage reservoir which will give a head to the power station near Trieste or nearly 1,000 ft. It is estimated that 75,000 h.p. is available and that the station will be able to produce 180 million kWh per year.

GREECE.—According to the daily Press, the negotiations conducted in Paris by M. Diomedes, the Governor of the National Bank of Greece, with English, French, and Austrian bondholders concerned in the enterprise for an electricity supply for Athens, were concluded recently. An English power and traction company is principally concerned.

Coventry.—PROPOSED NEW POWER STATION.—The City electrical engineer has submitted a report to the Electricity Committee pointing out that the bulk supply from the Leicestershire & Warwickshire Electric Power Co., will only be sufficient to meet a part of the anticipated increased demands for an electricity supply. The Committee has recommended to the City Council that the Electricity Commissioners be asked for authority to proceed with the erection of the new power station at Longford, in accordance with the understanding arrived at with the Commissioners in the early part of the year.

Dumfries. — HYDRO-ELECTRIC SCHEME. — The Corporation Electricity Committee has under consideration a report prepared by the electrical engineer upon a proposed hydro-electric scheme.

Edinburgh.—ELECTRICAL PROGRESS.—Mr. Seddon, Corporation electrical engineer and manager, in a report to the Electricity Committee, refers to a chart submitted in May showing that the anticipated load for this winter would be 37,700 kW. Up to date the maximum load has already reached 39,400 kW, an excess of 1,700 kW. At the present time the Corporation is installing a 10,000-kW turbo-alternator, which, it is hoped, will be ready in the beginning of the year. To meet future

requirements up to 1938, an additional 25,000-kW turbo-alternator will be needed in 1928 and another in 1930. The Committee has decided that foundations shall be laid suitable for the extension of the station.

Epping.—ELECTRICITY SUPPLY.—The Rural District Council has given its consent to the application of the North Metropolitan Electric Power Supply Co., for a Special Order to supply electricity to parishes in the rural area. The company does not propose to use overhead lines.

Glasgow.—ELECTRICITY SUPPLY.—A report of the meeting between representatives of Messrs. Heenan & Froude, Ltd., and the Corporation Cleansing and Electricity Departments with regard to the power station to be installed at the Corporation's new refuse disposal works has been submitted by the electrical engineer to a sub-committee, which has recommended that the report be approved, and that the Electricity Department be authorised to purchase two 50-cycle feeder panels, as and when required, and that the question of an additional frequency changer be deferred until more definite information is obtained as to the Government's intentions relative to the adoption of a standard frequency.

Godalming.—PRICE REDUCTION.—The Urban Electric Supply Co. has decided to reduce the charge for electricity from 1s. to 10d. per kWh as from January 8th next.

Hastings.—LOANS SANCTIONED.—The Electricity Committee has received sanction to the borrowing of £6,850 for mains, and £30,925 for mains and plant in connection with the bulk supply of electricity to Bexhill Corporation.

Hove.—ELECTRICITY EXTENSIONS.—The Electricity Committee has recommended to the Town Council that further feeder mains be laid from the Davigdor Road works and the Hove Street sub-station at an estimated cost of £11,880.

Kendal.—ELECTRICITY CHARGES.—The Town Council has offered to supply electricity for power to the Barrow Ice and Cold Storage Co., Ltd., at 3d. per kWh up to 30,000 kWh per annum, and at 2½d. per kWh beyond. This scale is to apply to all power consumers in the borough.

Lincoln.—LOANS.—The Town Council has applied for sanction to the following loans:—Cables, £10,000; sub-station and equipment, £2,500.

Liverpool. — LOAN SANCTIONED. — The Corporation has received sanction to the borrowing of £136,674 for the provision of mains, transformers, and switchgear.

London.—BERMONDSEY.—At the last meeting of the Borough Council, the Electricity and Street Lighting Committee reported that it had considered the question of holding an inquiry into the electricity undertaking and recommended that Mr. W. C. P. Tapper, chief engineer to the Stepney Borough Council electricity department, be appointed to conduct the inquiry, and to report to the Council, the terms of reference to be as follows:—To investigate the financial position, technical equipment, and general administration of the electricity department, and to make recommendations as to whether any reorganisation of the department is necessary with a view to securing economies in working, and to effect a reduction in the price of current for light and power. Whether it is desirable to purchase all current in bulk from an outside source or whether it is more advantageous for the Council to continue to generate current itself. Whether the equipment of the station is efficient and economic, or whether all or any part should be replaced by more up-to-date machinery. Generally to make any recommendations necessary for the improvement of the undertaking, having regard to the new position existing in London by the creation of the Joint Electricity Authority. The recommendations of the Committee were agreed to by the Council.

Newcastle-upon-Tyne.—ELECTRICITY AGREEMENT.—The Electricity Committee has prepared an agreement between the Corporation and the Newcastle-upon-Tyne Electric Supply Co., Ltd., for the supply by the Company to the Corporation of such electrical energy as the Corporation may require at the rate of 0.55d. per kWh, subject to increase according to the rise in cost of coal. The Corporation to take a minimum quantity of 250,000 kWh. The company is to provide at its own cost the cable between the company's system and the Manors power station, together with switch panel. The agreement is to remain in force for a period of ten years from May 30th, 1925, and is determinable thereafter on six months' notice by either party.

New Zealand.—LAKE COLERIDGE.—The report of the Lake Coleridge hydro-electric undertaking for the year ended March 31st last shows a total income of £92,163, and working expenditure of £23,270, leaving a gross profit of £68,893. After meeting capital charges, &c., there was a net profit of £5,434. The electrical energy sold amounted to 51,287,033 kWh, as compared with 43,792,472 kWh in the preceding year, and the maximum supply demanded increased from 10,800 to 13,180 kW. Extensions to the generating plant are being made, and it is anticipated that additional plant with a capacity of 15,000 kW will be available by June, 1926. The area of supply is also being extended by the duplication of the present transmission line to Timaru, and the erection of a line to Oamaru.

WAIKATO (HORAHORA).—The accounts of the Horahora undertaking for the year ended March 31st last show a total revenue of £65,184, from which were deducted working expenses (£14,106), interest (£20,129), and depreciation (£9,757), leaving a net surplus of £21,192. The sales of electrical energy amounted to 41,281,159 kWh, an increase of 1,366,305 kWh, as compared with the preceding year, and the maximum supply demanded rose from 7,400 to 8,300 kW. The total system now supplied from Horahora, includes 1,396 miles of transmission lines varying from 50,000 V to 400 V. The Waikato system is being extended, and a 110,000-V line has been completed from Hamilton to Auckland. Other transmission lines of 110,000 V and 50,000 V are in course of erection.

Northern Ireland.—ARMAGH.—The Urban District Council has adopted a memorial to the Electricity Commissioners of Northern Ireland asking for sanction to the erection of a generating plant for the supply of electricity in the district.

NEWRY (CO. DOWN).—The Urban District Council has adopted a revised report submitted by Mr. P. A. Spalding of Dundalk, for the proposed electricity scheme for the town, the capital outlay upon which is estimated at £17,500.

Portsmouth.—LOANS.—The Electricity Committee has obtained sanction to the borrowing of £22,000 for mains, substations and equipment for the added area.

The Corporation is to apply for sanction to a loan of £750,000 for electricity extensions, &c.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

SLOUGH AND DATCHET.—*Slough and Datchet Electric Supply Co., Ltd.*—Lighting: 8½d. per kWh.

WINDSOR.—*The Windsor Electrical Installation Co., Ltd.*—Lighting: From 9½d. to 9d. per kWh. Heating: From 5½d. to 3d. per kWh. Power: A new rate of £5 per h.p. per annum, plus 1d. per kWh, or alternatively the lighting rate.

Ringwood.—INQUIRY.—An inquiry was held recently by Sir William F. Marwood into the application of the Ringwood Electric Supply Co., for permission to erect overhead cables and service connections in parts of the town. It was stated on behalf of the company that unless the use of overhead mains was permitted a supply of electricity could not be provided for the district in question. There was opposition on the ground of unsightliness, the narrowness of the roads, and the depreciation of property.

Sicily.—ELECTRICITY SCHEME.—A scheme is at present under consideration to supply electricity on the island of Sicily from the hydro-electric station in Calabria, the southernmost province of Italy. Three plans for conveying electricity at a pressure of 130,000 V across the Straits of Messina have been prepared. The first provides for an overhead line, supported at each end on steel towers 993 ft. high. It is estimated that there would be a sag of 770 ft. from the horizontal in the centre of the line. The second scheme provides for the construction of two 656 ft. shafts and a tunnel about 2¼ miles in length below the Straits at a depth of 378 ft. below sea level. The third scheme is that of the Pirelli Co., of Milan, which proposes a new type of submarine cable which, although laid on the bed of the sea, would, it is claimed, be capable of successfully transmitting the necessary electrical energy.

Tonbridge.—NEW ELECTRICITY CHARGE.—The Urban District Council has decided to supply electricity for ordinary power purposes at a flat rate of 2d. per kWh as from January 1st next, and to abolish the maximum demand rate.

Walsall.—ELECTRICITY EXTENSIONS.—The scheme for linking up the electricity undertakings in the West Midlands was the subject of a further report at a recent meeting of the Corporation Electric Supply Committee. From this, it would appear that the main transmission lines between Ocker Hill and West Bromwich, West Bromwich and Walsall, and Walsall and Wolverhampton, will be laid forthwith, the extension of the Walsall generating station being regarded as another immediate step necessary. This extension (10,000 kW) is estimated to cost £175,000, and the linking up £200,000.

Worcester.—ELECTRICITY EXTENSION APPROVED.—At a recent meeting of the City Council a recommendation by the Electricity Committee to spend £47,000 upon extensions of plant at the electricity works was approved.

Tramway and Railway Notes.

Bradford.—ACCIDENT.—In the fog, on December 7th, a Corporation tramcar, proceeding from the depôt to the Idle terminus, got out of hand and crashed into the Alexandra Hotel, Idle, the driver and conductor being killed and the car completely wrecked. It is thought that a skid occurred on frosty rails when the brakes were applied.

Burnley.—TRAMWAY EXTENSION.—The Tramways Committee proposes to extend the tramway past the football ground in Brunshaw Road to Stroyan Street, and has recommended that estimates be prepared.

Continental.—BELGIUM.—Good progress is being made with the electrification of the local railways between Antwerp and Santhoven and Antwerp and Schilde. All the standards have been erected, and the cables are now being fixed in position.

ITALY.—A new company has lately been formed at Stradella with a capital of 1,000,000 lire and the title La Società Tramvia-Elettrica Stradella-S. Maria della Versa, to construct an electric tramway between the two towns named.

The Italian State Railway authorities have voted a sum of 60 million lire for the electrification of the railway between Bolzano and Brennero.

(*Continued on page 983*)

A Modern Electric Motor Manufactory.

The Works of Messrs. Electromotors, Ltd., at Openshaw.

In view of the fact, which all users will readily admit, that the construction and workmanship of electric motors do differ, which dissimilarity however may not always be assessed at its due value, it may be questioned whether the average purchaser exercises sufficient discrimination when buying an electric motor. Such a doubt adds interest to the progress that has been achieved by a manufacturing concern of which high-class construction has been the main object throughout its existence.

Fig. 1.—Shell-boring Machine Shop.

The organisation has been built up from its earliest stages by the present managing director, Sir Benjamin Longbottom, assisted by a trained staff of designers and specialists in the manufacture of electric motors and their application to industry. Launching out in 1900 with new works at Openshaw, Manchester, specially built for the purpose, the company set itself the task of producing a range of direct-current motors up to 25 h.p. of a class not hitherto attempted.* From that period onwards extension has followed extension—in 1908, 1912, 1919, 1921, 1924—and the range of sizes manufactured has been enlarged until today the works are amongst the finest plants in Great Britain for the manufacture of electrical machinery up to units of 250 h.p. in size.

Something more than pure design was required to achieve the results aimed at, and methods had to be employed which do not apply in the general engineering industry, or to those works wherein large varieties of machines are made. Some 24 sizes of d.c. machines and a similar number of a.c. machines represent the whole product of the works, and so it is evident that precision demands a perfect system of jigging, not merely designed for quantity production, but essentially for accurate production, which by their nature inherently enable production costs to be kept down. The provision of suitable jigs and gauges for every machining operation is under the direct control of the tool room, whose duty it is to keep them constantly checked for accuracy against standards. Some of the jigs are of a most elaborate nature; for instance, for every carcase size there is a jig which takes the whole carcase, and every hole in the carcase is drilled at one setting through steel-bushed holes; but even this is not final, as every piece of machinery goes through a separate examining department.

*See ELEC. REV., September 25th, 1908; p. 499.

Fig. 2.—Mechanically Finished Motor Body Stock.

The accompanying illustrations give a very clear indication of the organisation, and represent generally a tour through the works, leaving out those subsidiary departments which act merely as feeders to the main productive sections. In explanation, it should be mentioned that, broadly speaking, the mechanical features of the field frames and bearings are always constant, so that it is thus possible to produce each of these standard frames in quantity to a finished mechanical stock, instead of to individual orders, and the layout of the works is arranged on this basis. It is this very factor, coupled with the excellent system of jigging, which enables "precision-made" machines to be produced on a competitive basis.

The first of the accompanying illustrations shows a section of the machine shop with the shell-boring machines in the foreground, while the third shows a further section of the shop with the range of boring machines at work on bearing covers, and the second shows the mechanically finished stock of motor bodies, both d.c. and a.c. This is the normal condition of this section of the works, which is

Fig. 3.—Boring Machines at Work on Bearing Covers.

being constantly fed by the machine shops and withdrawn from by the erecting department.

The general stores are worked on a maximum and minimum stock basis to facilitate that prompt service and delivery to customers which is so essential; fig. 4 illustrates a section devoted to the forming of armature, stator and rotor coils, and field coils, and the insulating and taping thereof, while fig. 5 is a view of the general winding department. The shops illustrated above are all productive departments, and fig. 6 shows where the component parts come together for assembly prior to passing through to the three testing departments, two of which are shown in figs. 8 and 9, being the d.c. and a.c. sections respectively; the final stage of painting and packing is shown in fig. 7.

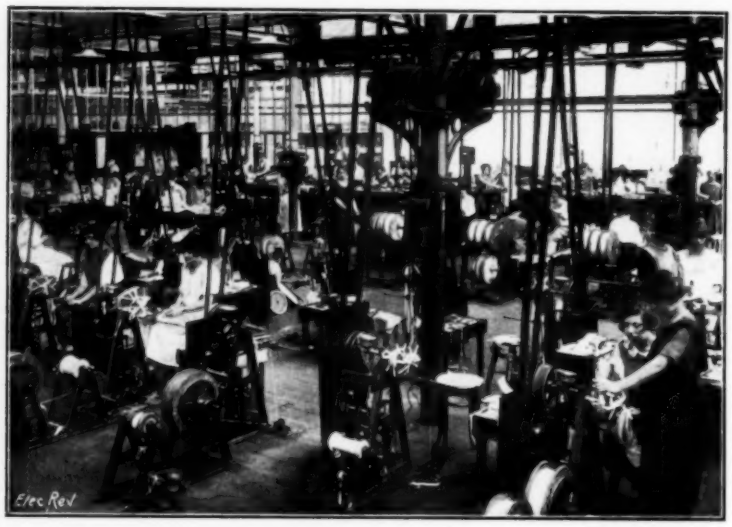


Fig. 4.—Coil-forming Department.

This description would not be complete without fuller reference to the products manufactured, which cover sizes from 1 up to about 250 h.p.

Some two years ago the machines were entirely re-designed; the type is universal in character and, by the addition or exchange of standard parts, can be adapted to meet widely differing requirements. Both the direct- and alternating-current motors are therefore available in the usual standard types, *i.e.*, enclosed ventilated, cowl or pipe ventilated, watertight, &c., for horizontal running and with vertical spindles for deep-well pumps, ships' bilge pumps, &c.

In a.c. motors, in addition to the ordinary standard squirrel-cage and wound-rotor types of machine, the firm also manufactures a high-torque squirrel-cage motor, having an efficiency and power factor comparable with those of an ordinary squirrel-cage motor, a type which is so largely filling the field hitherto held by the wound-rotor machine. Another speciality is the "Lo-thermo" motor, both d.c. and a.c., manufactured under the licence of Lo-thermo Patents, Ltd., which represents a practical solution of the difficulty of disposing of the conversion losses, which, in a watertight motor, of whatever form, have to be dissipated by radiation through the frame of the machine. The design incorporates the provision of additional radiating surface in the interior air-circulating circuit, and thus utilises material to the best advantage and maintains a highly efficient totally-enclosed motor. Other manufactures include wound-rotor machines with a flameproof slip-ring enclosure for use in fiery mines, and auto-synchronous and synchronous motors, within the limits indicated above.

To indicate the thoroughness of both design and construction, let us examine the standard three-phase squirrel-cage motor: The stators, which have semi-closed slots, are ground by a special machine to ensure the bore being central with the bearing seating to an accuracy of 0.5 of a mil; the rotors, which are built up on spiders, except the smallest sizes, are also ground to the same degree of accuracy, and it is therefore obvious that with the use of ball and roller bearings there can be no danger of the rotor not running central. Reliance is not placed on the simple forcing of the ball or roller race on to a ground shaft, but the latter is specially treated to provide for the reception of this race, and in every case a nut with a locking arrangement is provided as an

Fig. 5.—General Winding Shop.

Fig. 6.—Assembly of Component Parts.

Fig. 7.—Painting and Packing Section.

additional security. The slots are skewed and the rotor bars are brazed to the end rings. Impregnation of the windings is carried out to the extent of putting the whole stator into the impregnating tanks, and no machine is passed on to a customer until it has been thoroughly tested.

Fig. 8.—Direct-current Testing Department.

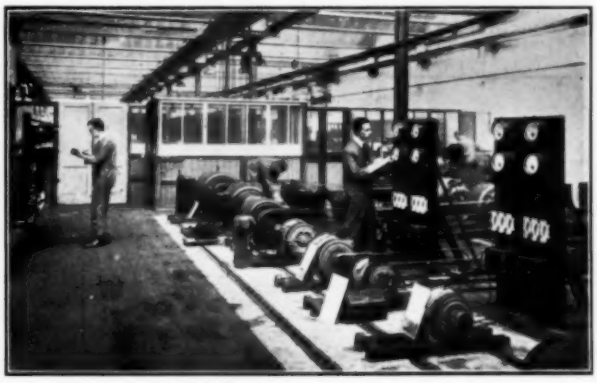


Fig. 9.—Alternating-current Testing Bay.

To a user all these features offer a safeguard of value, much more so to the user overseas, whilst as the whole energies of the Company are concentrated on this range of manufactures, it is able to give a very real and definite service in dealing with purchasers' requirements, especially with regard to prompt deliveries; and concentration on the production of high-class machines has resulted in the firm enjoying the confidence of the home and many oversea Government departments, the home, Indian State, and other oversea railways, the leading shipping lines, most of the home municipalities, and industry generally.

New Automatic Telephone Exchanges.

Leeds Satellite Exchanges, and Strowger Equipment in South Devon.

So far the largest provincial city in Great Britain to be favoured with automatic telephone service is Leeds. The original Strowger equipment was installed under considerable handicap during the war, and was made available for public service in May, 1918, at which date the total number of subscribers was 6,800, but extensions since added bring the present total to 9,600 lines.

Hitherto the outlying suburban exchanges in the Leeds area have been manually operated, but the disparity has now been remedied, for four such exchanges have been equipped with Strowger automatic switching apparatus to operate in conjunction with that at the main Leeds exchange.

Fig. 1.—Headingley Automatic Telephone Exchange.

Fig. 2.—Chapeltown Strowger Telephone Exchange.

Four Satellite Exchanges at Leeds.

The capacities of the four new above-mentioned exchanges are shown in Table I; in addition, a 200-line extension is in hand at Stanningley, which will ultimately give this exchange a full capacity of 1,000 lines. The equipment at all four exchanges is similar, with the exception of variations in the number of Strowger units and associated selector switches, according to the relative capacities; like that at the Leeds main exchange, the system is five-digit, which involves the use of switching selector repeaters at the satellite exchanges, which perform several functions according to the nature of the call, whether local or distant. Groups of numbers have been allotted to the different exchanges, and automatic subscribers have access to all other automatic subscribers in the Leeds multi-office area by dialling in the requisite group.

In each case the equipment is housed in a new building, fig. 1, located as near as practicable to the economic "telephone centre" of the district it serves. The switchrooms accommodate standard 100-line Strowger line-switch units, fig. 3, and on one side of each unit the rotary line switches are mounted on "gates," fig. 5, each with a capacity for 50 switches, which can be swung outwards for inspection or adjustment. On the other side are fitted the final selectors.

TABLE I.

	Regular subscribers' lines.	P.b.x. lines.	Total lines.	Ultimate capacity.
Headingley ...	1,400	100	1,500	2,400
Chapeltown ...	1,200	100	1,300	2,100
Roundhay ...	1,100	100	1,200	2,000
Stanningley ...	600	200	800	1,000

Composite trunk boards carry the switching selector repeaters, "O" level repeaters, distributor switches, two-party line equipment, and coin-box repeaters. The selector trunk boards proper have capacities for 240

switches, or 20 per shelf. Outgoing secondary line switches are employed to select and seize a disengaged trunk for distant calls; at the main exchange these trunk connections terminate in first group selectors. The outgoing secondary line switches are located at the satellite exchanges, each rack of five shelves accommodating 25 switches.

The main batteries are in duplicate, and the charging motor-generators run off the a.c. supply mains. The two ringing rotary converters at each exchange work off the main battery, and also supply the various "tones" required.

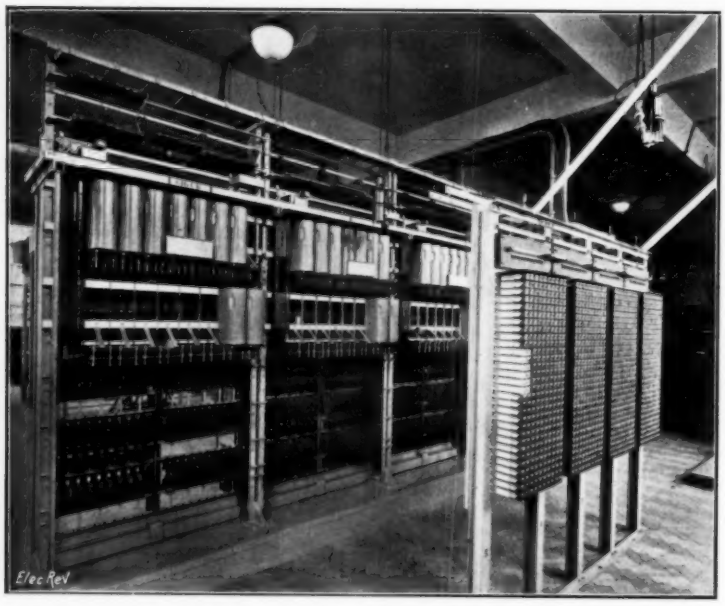


Fig. 3.—Roundhay Exchange; Back view of Line-switch Units, Meter Rack in Foreground.

Although the conversion of these four Leeds satellite exchanges eliminates manual telephonists for all local calls in the Leeds multi-office area, their services will still be required in connection with all trunk calls as well as for traffic incoming from unconverted exchanges outside the area. Automatic supervisory and fault-signalling equipment is a feature of the satellite and main exchanges, and suburban Leeds will now reap the maximum benefit from the change.

The Torquay Exchange.

Two delightful South Devon resorts will henceforth enjoy the advantages of automatic telephone service, both installations having been cut into service on October 31st. Torquay is a seaport and health resort with a population of over 40,000. Paignton lies only two miles south of Torquay, and has a population of over 15,000. Both installations are completed in so far as immediate requirements are concerned, although there is an extension of some 200 additional lines in hand for Torquay, which is to be ready for service early next year. The Torquay exchange is located at the Post Office, and comprises 19 Strowger units equipped with rotary line switches and final selectors. Of the 1,800 lines initially provided for, 1,600 are regular subscribers' lines, and 200 are p.b.x. lines; provision is also made for 40 coin-box lines. The system is 4-digit, so that all Torquay subscribers dial four-figure numbers for local calls, the numbers for Torquay being in the 2 and 3 thousand group. The present equipment is arranged to accommodate St. Marychurch subscribers, whose numbers lie in the 7 thousand group. Access to Brixham, a satellite to the Paignton exchange not yet converted to automatic operation, is obtained by dialling "57" when the Brixham operators complete the call.

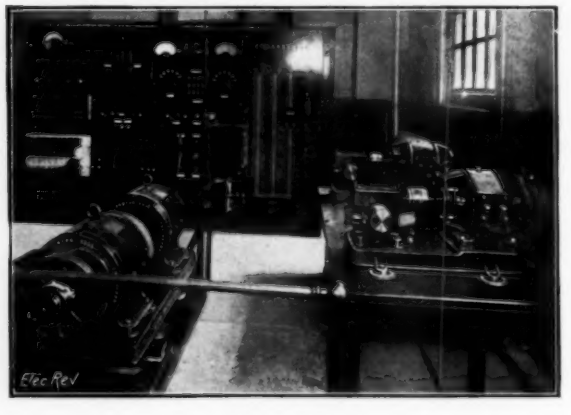


Fig. 4.—Torquay Exchange Power Plant.

The power board at the Torquay exchange, fig. 4, comprises four panels: On the left-hand panel is mounted the supervisory equipment, and the fourth panel is associated with the manual equipment. The main batteries are in duplicate, comprising two sets of 25-BPW, 9-element Chloride cells in lead-lined wood boxes, and the present capacity of each battery is 602 ampere-hours. The charging motor-generator, by Newton Bros., has an output of 110 amperes at 57 volts and a speed of 1,000 r.p.m. One of the ringing dynamotors (fig. 4, right) is designed for direct connection to the supply mains, and the other for working off the main battery in series with an impedance coil. The supervisory alarms are divided in order of urgency; the non-urgent alarms indicate transient or non-persistent faults, and the main alarm indicates the exact nature of a fault and its location.

The Paignton Exchange.

The automatic exchange serving Paignton comprises eight Strowger 100-line units, accommodating a total of 700 lines, 600 of which are regular subscribers' lines and 100 p.b.x. lines. Of these units one is specially equipped with 20 rotary line switches for coin-box service. The system is also four-digit, with numbers in the 5 thousand group. Paignton subscribers dial direct to Torquay and St. Marychurch subscribers, and have access to the operators at Brixham.

Fig. 5.—Stanningley Exchange; Rotary Line Switch Units.

The entire equipment of the above-mentioned exchanges was manufactured and installed for the Post Office Telephone Department by the Automatic Telephone Manufacturing Co., Ltd.

Tramway and Railway Notes.

(*Continued from page 978.*)

Irish Free State.—THE LUCAN (DUBLIN) ELECTRIC RAILWAY.—It is announced that the Dublin United (Electric) Tramway Co. is willing to purchase and work the Lucan-Dublin Electric Railway services which have been suspended in recent months, provided the Dublin City Commissioners and the townships agree to postpone for 42 years the right to purchase the tramway within their respective areas. The Dublin Commissioners and the Blackrock Urban District Council have given consent, and the consent of the other townships concerned is anticipated.

Kidderminster.—TRAMWAY IMPROVEMENTS.—The Kidderminster and Stourport Tramways Co. is contemplating the doubling of its tramway track and carrying out extensions in Vale Road.

London.—PROPOSED NEW TUBE.—According to *The Times*, the Metropolitan Railway Co. is seeking Parliamentary powers to construct a relief line which, it is expected, will materially facilitate the manipulation of traffic in North-West London. It is proposed that the new line will run parallel, on a falling gradient, with the existing Metropolitan line from a point immediately south of Willesden Green Station as far as Mapesbury Road, which is a short distance north of Kilburn and Brondesbury Station, making a triplicate "up" and "down" line over this portion of the railway. The proposed line will then change direction and run under the company's fast and local lines, entering two deep-level tunnels which will take the line under High Road, Kilburn, Maida Vale, and Edgware Road, and join with the Metropolitan "Inner Circle" lines by means of a 200-yards "cut and cover" section a few yards west of Edgware Road Station. The line will run through the administrative areas of the urban district of Willesden, the boroughs of Hampstead, Paddington, and Marylebone, and will have three stations conveniently placed along the route.

UNDERGROUND STATION RECONSTRUCTION.—The Underground Company has placed a contract with Messrs. James Carmichael, Ltd., for the entire reconstruction of the City line stations at Clapham Road and Oval. The schemes include the removal of the lifts and the installation of escalators, and it is expected that the new stations will be completed in about May of next year.

Perth.—TRAMWAY IMPROVEMENTS.—The Corporation Tramway Committee has adopted a recommendation that the whole of the tramway track be electrically welded.

Sheffield.—NEW DEPOT.—The Corporation is to spend £85,000 on the erection of a new tramway shed and garage at Trenter Street. Fifty new tramcars and 15 new motor-buses are on order.

Telegraph and Telephone Notes.

China.—TELEGRAPH CHAOS.—As a result of the struggle between the rival war-lords in China, says the *Daily Mail*, the Great Northern Telegraph Co. gave notice on December 11th of indefinite delay to cablegrams intended for Peking, the capital, "owing to the total interruption of Chinese landlines."

France.—TELEGRAPH RATES.—As from December 10th, French telegraph and telephone rates for international communication have been multiplied by five, as compared with 4.9 at the beginning of the month. The figure has been steadily rising for some time; at the beginning of August it stood at four.—*Reuter* (Paris).

Irish Free State.—AUTOMATIC TELEPHONY.—Some months ago Mr. J. J. Walsh announced that Dublin would within a few years be completely equipped with automatic telephones. The first automatic telephone exchange is to be opened in Ship Street next year, but it is understood that the change cannot be completed before 1932.

Rugby Radio Station.—TESTS.—The Government's radio-telegraph and telephone station at Rugby, one of the largest in the world, has been completed and will, *The Times* expects, be working on January 1st. Experimental transmission has been carried out for some time, and Morse messages on a wave-length of 17,500 metres have been heard clearly in Australia, also in America and South Africa.

Jugo-Slavia.—STOCKHOLM POSTAL CONVENTION.—Parliament ratified the Universal Postal and Telegraph Convention of Stockholm on December 11th.—*Reuter* (Belgrade).

The Telephone Service.—OPERATORS.—Post Office statistics show that of the 9,325 applicants for positions as telephonists last year, only 1,551 girls were able to qualify for service. The chief causes of failure are stated to be: Defective or slovenly speech, undesirable accent, defective hearing or eyesight, and bad spelling.

United States.—"TELEPHONE SKYSCRAPER."—The largest telephone exchange in the world will be opened in New York next March by the New York Telephone Co. It occupies an entire block, one acre in extent, and faces the waterfront. The new exchange is 32 storeys high; the first ten floors cover the full acre and the remainder taper off in accordance with the building regulations. Actually, six exchanges will be housed in the building, and they will control 120,000 telephones. While most of the exchange buildings in the city districts will still be maintained, the business for them all will be managed by 6,000 employés in the new building. The building stands 498 ft. above ground (nearly a third higher than St. Paul's), and there are also five floors extending 72 ft. underground. The total cost will be more than £3,000,000.

Radio Notes.

Daventry.—MISHAPS.—The British Broadcasting Co.'s high-power station (5XX) at Daventry ceased transmitting for a while on Saturday afternoon, December 12th; due to a technical defect it again stopped radiating for a few minutes on Monday evening last.

France.—LICENCES.—The question which has been exercising the minds of the 700,000 French listeners for three years —"Will there be a State monopoly of broadcasting?"—has been settled, the State virtually accepting the trust through its imposition of taxes on wireless receiving sets. The *Daily Mail* explains that the new taxes on receivers are: 60 fr. (about 9s. 6d. at the present exchange rate) for the first year and 50 fr. (8s.) for the succeeding years on all valve sets; and 20 fr. (3s. 2d.) for the first year and 15 fr. (2s. 4d.) for the succeeding years on crystal sets. Listeners must pay 10 times the amount due if they are found to be pirates, and there is also a tax of 2 fr. (about 4d.) on the sale of valve sets, failure to pay involving a liability of from £4 to £8.

Korea.—BROADCASTING STATION.—His Majesty's Consul-General at Seoul (Mr. Arthur Hyde Lay) reports to the Department of Overseas Trade that arrangements have been made for the foundation of a broadcasting station in Seoul. The prospectus issued by the Preparatory Committee states that the projected Broadcasting Bureau will make provision for the whole country daily, in both Japanese and Korean. The monthly charge for a receiver is estimated at 2 yen, and contributors to the capital fund of the Board will be granted a 50 per cent. or more reduction, which is to be increased as the number of subscribers increases. The Corporation maintaining the Bureau will be capitalised at 200,000 yen and the gross receipts of the first year are estimated at 102,000 yen, of which amount 12,000 yen will be net profit. Membership of the Corporation will be of two classes: ordinary membership can be obtained by subscribing for one or more shares of 100 yen each, and special membership by subscribing for five shares or more.

Radiophony Union.—BRUSSELS MEETING.—Delegates from 11 European countries met on December 14th in Brussels, under the auspices of the International Radiophony Union to consider plans for improving the wave-length interference problem. Great Britain was represented by Capt. P. P. Eckersley.

Ships' Radio Operators.—STRIKE.—Mr. J. C. A. Ward, chairman of the Engineering and Allied Employers' (London and District) Association, in a statement to a Press representative, is reported to have said that the number of ships' operators who have sailed under the reduced wages scale since the wages dispute commenced (up to December 14th) was over 300. He pointed out that since 1920 the wages of seagoing operators had fluctuated with the rise and fall in the wages of other seafarers, and in this respect the operators benefited with the other seafarers in the increase given in 1924. The present reduction was less onerous for operators than for the other seafarers, inasmuch as the reduction for the latter commenced as from August 1st, whereas that for the operators commenced on December 1st, or four months later.

Ships' Wave-lengths.—MODIFICATION.—It is reported that the radio-telegraph installations aboard the Southern Railway Co.'s 25 passenger ships, and also those of its Newhaven and Dieppe land stations, are to be converted so as to work on a wave-length of 800 metres, thus avoiding interference with the B.B.C. programmes on the South Coast.

United States.—RADIO CONFERENCE.—There is an "awful warning" of what may happen in Europe in the recommendations of the Fourth Annual Radio Conference in the U.S.A., held a week or two ago in Washington. According to the *Evening News*, drastic steps were called for by a committee, and the 600 members of the conference accepted the proposals with only occasional modifications of details. On the subject of congestion on broadcast wave-lengths, for instance: "The conference was overwhelmingly in favour of granting no more licences until the number of existing stations is materially reduced," and voted for "progressive reduction of the number of broadcasting stations." It also "opposed the granting of additional licences by dividing time with existing stations." Another recommendation is that of the abandonment of spark telegraphy by amateurs, which interferes with the reception of programmes transmitted on ultra-short wave-lengths by some of the big American stations. Most drastic of all is the recommendation for dealing with the "howler." The conference urged that a definite date should be fixed after which the manufacture of "radiating receivers" should be prohibited, and that if manufacturers disregarded this recommendation an attempt should be made to make the manufacture of radiating receivers illegal.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—April 12th, 1926. State Electricity Commission of Victoria. Plant for the Sugarloaf and Rubicon hydro-electric scheme, consisting of turbo-generators, transformers, switchgear, cranes, and accessory plant. (December 11th.)

Victorian State Railways. January 20th, 1926. Automatic battery-charging equipment.* January 13th. Double recording wattmeter.*

Ayrshire.—December 31st. Education Authority. Electrically wiring the extension to Ochiltree school. Specifications from Mr. Wm. Reid, master of works, Education Offices, Ayr.

Beckenham. — January 14th. Electricity department. ater heating and softening plant. (See this issue.)

Belgium.—December 30th. Belgian Ministry of National Defence, 10, Rue du Méridien, Brussels. Wireless telegraph apparatus for use on military aeroplanes. Particulars (Cahier des Charges Special, No. 636) for 4 fr., from 15, Rue des Augustins, Brussels.

December 29th. Portable accumulators for the telegraph section of the Belgian Army. Particulars (Cahier des Charges, No. 655) for 5 fr., from 15, Rue des Augustins, Brussels.

Brentwood.—January 1st. Guardians of Billericay Union. Electrical wiring in conduit and installation of complete electric generating plant at the Institution, Billericay. (December 11th.)

Dublin.—December 29th. Commissioners of Public Works. Installation of electric lighting at the Irish Land Commission Offices, Upper Merrion Street, Dublin. Specification (20s.) from the Secretary, Office of Public Works, Dublin.

Dundee.—January 14th. Electricity Department. Two electrically-driven centrifugal drainage pumps controlled by float gear. (See this issue.)

Edinburgh.—January 4th, 1926. Electricity Supply. Two 1,200-b.h.p., 6,600-V, 3-ph. induction motors. (December 11th.)

Edmonton.—Education Committee. Wiring offices at Brettenham Road, Edmonton, for electric light. (December 11th.)

Egypt.—CAIRO.—February 20th. Director-General, Mechanical Department, P.W.M. Power plant for Giza.—*Reuter's Trade Service* (Cairo).

January 20th. Local Commissions Section. Electric motor and accessories for Manfalout waterworks.*

Glasgow.—December 21st. Corporation. Electric lighting works at Bellefield Sanatorium. Specifications from Office of Public Works, City Chambers. Electric lighting works at Possil and Balornock housing schemes. Specifications, &c., from Mr. R. B. Mitchell, 75, Waterloo Street, Glasgow.

Kilmarnock.—Corporation. Electric lighting of tenement houses. Schedules from Mr. W. Dunbar, burgh surveyor.

London.—LONDON COUNTY COUNCIL.—December 31st. Renewal of the storage battery at Bexley Mental Hospital. (December 11th.)

CAMBERWELL.—January 11th, 1926. Borough Council. Stores, including electric lamps, for 12 months. Particulars from Borough Engineer, Town Hall, Camberwell.

METROPOLITAN ASYLUMS BOARD.—December 30th. Installation of fire-alarm system at Tooting Bec Hospital. (See this issue.)

Manchester.—December 30th. Electricity Committee. One single unit (or, alternatively, one double unit) three-phase induction regulator. (December 11th.)

Two 1,000-kW and seven 750-kW motor converters, or, alternatively, rotary converters and static transformers. (See this issue.)

Marsden (Yorkshire).—December 23rd. Installation of electric lighting at Liberal Club. Mr. G. Holroyd, 28, Peel Street, Marsden, near Huddersfield.

New Zealand.—WELLINGTON.—February 16th. Outdoor switchgear for the Waikato electric power scheme.*

AUCKLAND.—February 8th. Auckland Electric Power Board. Overhead cotton-covered triple-braided cable.*

February 22nd. 15-amp. cut-outs.*

Preston.—January 15th. Electricity Department. Supply and erection of approximately 15 miles of 33,000/45,000-V double transmission lines. (December 11th.)

South Africa.—JOHANNESBURG.—January 28th, 1926. S.A. Railways and Harbours. Eleven 4-ton electrically-driven wharf jib cranes and seven electric capstans for Durban Harbour. Secretary to the Tender Board, S.A.R. Headquarters, Johannesburg.*

UNION TENDER BOARD.—January 28th. Miscellaneous telegraph and telephone materials for the Department of Posts and Telegraphs.*

Uruguay.—February 23rd, 1926. State Electricity Supply Works. Porcelain insulators and accessories.* D.c. and a.c. meters.*

Wakefield.—The Corporation is inviting tenders for the installation of electric lighting at the Corporation baths.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Barnsley.—Electricity Committee. Recommended:—
Cables.—Scheduled prices based on electrolytic copper bars at £65 10s. per ton, and English lead at £33 per ton.—British Insulated and Helsby Cables, Ltd.

Carlisle.—Electricity Committee. Accepted:—
Cast-iron piping for condensing-water system (£4,795).—Pratchett Bros.
Large water valves (£1,199).—Blakeborough & Sons.
3-ton crane and gantry (£268).—Herbert Morris, Ltd.

Chesterfield.—Electricity Committee. Accepted:—
2,000 yd. of cable (£410 10s.).—Western Electric Co., Ltd.
1,250 yd. overhead distribution cable (£235).—Macintosh Cable Co., Ltd.

China.—SHANGHAI.—Electricity Department. Accepted:—
Four large air preheaters (total heating surface 192,800 sq. ft.), for the Riverside power station.—Howden-Ljungström Preheaters (Land), Ltd.

Dorchester.—Electricity Committee. Recommended:—
Recording ammeter.—Elliott Bros.

East Ham.—Lighting Committee. Accepted:—
Switchgear (£250).—A. Reyrolle & Co., Ltd.

Glasgow.—Baths Committee. Recommended:—
Installation of electricity at Cowcaddens Workhouse (£265).—Chas. Maguire.

Tramways Committee. Recommended:—
Rheostats for cars.—Traction Equipment Co., Ltd., and Electro-Mechanical Brake Co., Ltd.
Steel track shoes.—Acme Steel and Foundry Co., Ltd., and N. B. Steel Foundry, Ltd.
Brake chains.—Weldless Chains, Ltd.

Gravesend.—Electricity Committee. Recommended:—
Boiler-house extension (£1,800).—Hopkins & Sons.

India.—High Commissioner. Accepted:—
Two contracts for hydraulic plant for the East India Railway locomotive works at Lucknow and Jamalpur.—Hollings & Guest, Ltd.

London.—ST. PANCRAS.—Electricity and Public Lighting Committee. Recommended:—
Steam-recording apparatus for two new boilers (£547).—Industrial Combustion Engineers, Ltd.
Two 1,000-kW motor converters (£8,212).—British Thomson-Houston Co., Ltd.

LONDON COUNTY COUNCIL.—Highways Committee. Reconstruction of switchgear at Shoreditch sub-station:—

A. Reyrolle & Co., Ltd.	£3,989*
Ditto, (alternative)	4,113
Bertram Thomas	3,989*
(alternative)	4,113
Metropolitan-Vickers Electrical Co., Ltd.	4,776
(alternative)	**4,080**
(further alternative)	4,527
Ferguson Pailin, Ltd.	4,729
General Electric Co., Ltd.	4,920
English Electric Co., Ltd.	5,072
Johnson & Phillips, Ltd.	5,259
Park Royal Engineering Co., Ltd.	5,424
Switchgear & Cowans, Ltd.	5,945
British Thomson Houston Co., Ltd.	6,029
New Switchgear Construction Co., Ltd.	6,612
Whipp & Bourne, Ltd.	9,490

*Not to specification.

The tender of Metropolitan-Vickers Electrical Co., Ltd., at £4,080, less £441 in respect of a battery-charging set and panel quoted for, has been accepted by the Committee.

PADDINGTON.—Great Western Railway Co.
Gas-filled lamps.—Siemens & English Electric Lamp Co., Ltd.

Portsmouth.—Board of Guardians. Accepted:—
Electrical stores and electric lamps.—H. A. Evans.

Stafford.—Electricity Committee. Accepted:—
Boiler feed pipes.—Aiton & Co., Ltd.

Stourport.—
Wiring the Stourport lighting and power station for electric light.—B. French.

Sunderland.—Corporation. Accepted:—
De-aerating plant.—Hick, Hargreaves & Co.
500 15-amp. meters.—Robert Hornby & Co., Ltd.

Weymouth.—Electricity Committee. Accepted:—
Laying mains (£650).—Johnson & Phillips, Ltd.

Forthcoming Events.

Manchester Electro-Harmonic Society.—Friday, December 18th. At the Albion Hotel, Piccadilly, Manchester. Smoking concert.

Junior Institution of Engineers.—Friday, December 18th. At E.L.M.A. Lighting Service Bureau, 15, Savoy Hill, Strand, W.C. At 7 p.m. Lecture on and demonstration of industrial and domestic electric lighting.

British Electrical Development Association.—Friday, December 18th. At Australia House, Strand. Display of electrical films.

Birmingham Electric Club.—Friday, December 18th. At the Grand Hotel, Colmore Row, Birmingham. At 7 p.m. Annual meeting.

Salford Technical and Engineering Association.—Saturday, December 26th. At the Royal Technical College. At 5.30 p.m. Annual social.

Notes.

The Electrical Engineers' Ball, 1926.—The seventeenth annual Electrical Engineers' Ball will take place at the Hotel Cecil on Friday, February 12th, 1926. The event is one of the outstanding features of the London electrical season, and for the information of those of our readers who are interested we give below, as usual, a full list of the members of the general and executive committees:—

GENERAL COMMITTEE.

Addenbrooke, G. L.	McKinstry, A. E.
Alabaster, H.	McKay, H. J. S.
Andrews, Leonard	McClelland, Wm., C.B.
Atkinson, Ll. B.	McMahon, P. V.
Baldwin, O. H.	Matthews, W. Lee
Balfour, George, M.P.	Midgley, H. E.
Bowden, J. H.	Mordey, W. M.
Byng, E. G.	Moss, E. W.
Callender, Sir T. O., J.P.	Nalder, F. H.
Chattock, R. A.	Nash, Sir P., K.C.M.G., C.B.
Cramb, A. C.	New, E. S.
Cridge, A. J.	Noble, Sir Wm.
Couzens, H. W.	Partridge, G. W.
Devonshire, Sir J. L., K.B.E.	Pooley, F.
Elder, T. C.	Purves, Col. T. F.
Fairman, H. W.	Pybus, P. J., C.B.E.
Ferranti, Dr. S. Z. de	Railing, M. J.
Fox, E. J.	Robinson, L. L.
Gatehouse, E. A.	Rogers, F. M.
Geipel, Kenneth	Rowell, P. F.
Gill, Frank	Sayer, C. E.
Gillespie, M. M.	Scholey, H., C.B.E.
Gray, James	Shaughnessy, E. H.
Gregory, J. P.	Siddeley, H. C.
Gridley, Sir Arnold, K.B.E.	Sillar, A. M.
Hadley, A. E.	Snell, Sir John, G.B.E.
Highfield, J. S.	Sparks, Col. H. C., C.M.G., D.S.O.
Hill, C. W.	Sutton, Sir George, Bt.
Hirst, Sir Hugo, Bt.	Taite, C. D.
Hunter, P. V., C.B.E.	Taylor, Capt. Godfrey
Hughman, R. W.	Taylor, James, J.P.
Kemnal, Sir James, K.B.E.	Tresize, J. M. G.
Kerr, M. J. D.	Wallis-Jones, Capt. R. J.
Kingsbury, J. E.	Walton, A. H.
Knight, C. M.	Willock, David
Leaf, H. M.	Wilson, David
Leigh, Lt.-Col. F. A. Cortez	Woodhouse, W. B.
Lonsdale, W. Stanley	Worsdell, F. E.
McGregor, J. J., C.B.E.	

EXECUTIVE COMMITTEE.

O. H. Baldwin	H. W. Couzens.
W. S. Lonsdale	J. E. Kingsbury
A. M. Sillar	P. V. McMahon
R. J. Wallis-Jones	A. H. Walton

HON. SECRETARIES: A. M. Sillar; W. S. Lonsdale.
HON. TREASURER: J. E. Kingsbury.

"All-Electric" Houses.—An interesting experiment by the City of Birmingham Electric Supply Department, in electric (artisans') houses is to be made, for a week beginning December 14th, on the Woodlands estate, Northfield, Birmingham. One house is "all electric" and a second "electric" apart from one coal fire to heat the kitchen. The electrical equipment actually included in the purchase price (£500 each) of the "all-electric" houses is as follows:—A 3-kW wash-boiler; one 30-gallon hot water storage tank, constant loading 450 watts with boost load of 2,000 watts; one 6-kW Santon hot water geyser for intermittent use in kitchen; one 3-kW fire for drawing room; one 2-kW Utility fire for living room; one 2-kW fire for bedrooms; and the usual lighting points. A 6-kW cooker will be taken on hire from the Corporation Electric Supply Department.

The Liverpool Corporation has decided to erect 250 all-electric houses on the Walton Clubmoor estate. These houses will have electrical appliances for heating, lighting, cooking, washing, and hot water supply. They will be specially designed, and as they will have neither fireplaces nor flues, there will be no chimney pots. The cost of construction will be cheapened, although special means of ventilation will be provided. Our local correspondent was shown the type of electric fire which will be installed, producing the illusion of a live coal fire. All-electric house occupiers will get their electricity supply at the low price of ¼d. per kWh. The Corporation has obtained useful data from two all-electric houses which have given satisfactory results, on the Larkhill estate. The all-electric houses are of particular interest in view of the decision announced by the Minister of Health that an inquiry is being made to ascertain which local authorities are encouraging the adoption of devices in their houses to reduce the smoke nuisance. The Liverpool Housing Committee and the City Electric Supply Department are co-operating in the scheme. Pratically every house now erected in the Liverpool area is wired for electricity.

The Electrical Association for Women.—The recently inaugurated Glasgow and District Branch of the Electrical Association for Women commenced its activities on December 11th, by a visit to the Dalmarnock power station of the Glasgow Corporation electricity department. There was a good attendance of members, including Lord and Lady Belhaven and Stenton. After being shown round the power station the company had tea in the "all-electric" canteen. The branch secretary is Miss R. F. Kennedy, Electricity Showroom, 251, Suchiehall Street, Glasgow.

On Tuesday, December 8th, a party of 30 members of the E.A.W. visited the "Tricity" showrooms at the invitation of Mr. A. F. Berry. The party was first conducted round the showrooms, where there was a special display of "Sun Ray" radiators and other domestic apparatus. Tea was taken in the restaurant, after which Mr. Berry gave a talk on "Electricity and Health."

Late Legal.—SOUTHPORT CORPORATION *v.* BIRKDALE DISTRICT ELECTRIC SUPPLY CO., LTD.—Lords Birkenhead, Atkinson, Sumner, Wrenbury and Carson, on December 14th heard arguments in the House of Lords in the appeal of the Birkdale District Electric Supply Co., Ltd., *v.* The Corporation of the Borough of Southport. It was claimed by the Southport Corporation that by virtue of clauses included in indentures dated 1901 and 1904 it was entitled to prevent the appellants from charging higher prices for electrical energy within the district formerly within the jurisdiction of the old Birkdale Urban District Council, than the Corporation was charging within the original Southport area. Mr. Justice Astbury, in the Chancery Division, dismissed the Corporation's action, but the Court of Appeal, reversing his decision, granted an injunction. The company now appealed to the House of Lords, with a view to getting Mr. Justice Astbury's judgment restored. In stating the case for the company, Mr. Clauson said it was an attempt to fetter or abrogate statutory power and was *ultra vires*, whether such fetter was or was not incompatible with carrying out the general purposes of the undertaking, in relation to which the power had been conferred. Lord Birkenhead said that the appellants were asking to be allowed to repudiate part of the agreement while retaining all the advantages for which it was a consideration. Counsel said the terms of the transfer had, under statute, to be approved by the Board of Trade, and from that the conclusion was to be drawn that the only legal consideration was the consideration stated in the deed and approved by the Board. At the conclusion of the arguments for the appellants the Law Lords called upon Mr. Greene to put before them the case for the Corporation, and the learned Counsel was still speaking, when the further hearing was adjourned till December 15th. The Corporation submits that the Legislature has cast upon the appellants no obligation to make particular, or any charges for electrical energy supplied to consumers, and that there is nothing in the Birkdale Lighting Order, or the Electric Lighting Act, 1882, or otherwise in law to prohibit the appellants from entering into any reasonable business agreement to limit the charges to be made by them.

The hearing was continued on December 15th and at the request of Lord Birkenhead, the respondents' leading Counsel, Mr. Greene, proceeded to discuss the judgment of Mr. Justice Russell in the York Corporation case, in relation to power to trustees to make improvements in the navigation in the River Ouse, for which purpose they were authorised to levy tolls up to a certain rate.

The learned Counsel proceeded to indicate the differences which, he suggested, existed in the York case which distinguished it from the present one.

The House reserved judgment.

Inside Frosted Lamp Bulbs.—Lamp bulbs frosted on the inside in such a manner as to diffuse the light by refraction of the direct rays, are a feature of the new standard line of lamps recently introduced by the Westinghouse Lamp Co. The new line will consist of five sizes of lamps, and will replace a number of the forty-five lamp types of 100 watts and under now in common use. The first of the line, a 25-watt lamp, has already been placed on the market. This finish eliminates glare and makes it easy to keep the lamp clean, and so renders it more efficient throughout its life. It is claimed that the initial loss by absorption is less than 2 per cent. of the light output. In appearance the bulb is a neutral grey with a highly polished exterior and has the shape naturally taken by a falling drop of water; a coiled filament is used.

World Power Conference.—SECTIONAL MEETING.—We have received from the Secretary of the World Power Conference (36, Kingsway, London, W.C.2), the technical programme of the sectional meeting which is to be held at Basle from August 31st to September 12th, 1926. Section A deals with the "Utilisation of Water Power, and Inland Navigation"; Section B with the "Exchange of Electrical Energy between Countries"; Section C with the "Economic Relation between Electrical Energy produced Hydraulically and Electrical Energy produced Thermally.: Conditions under which the two Systems can work together with Advantage"; Section D with "Electricity in Agriculture"; and Section E with "Railway Electrification."

All papers will be printed in Switzerland under the supervision of the Swiss National Committee of the World Power Conference, and will be available for the participants before the Conference opens. It is intended that the papers, together with the discussions thereon, shall be published after the Conference by the Swiss National Committee in a special volume to be entitled "Transactions of the World Power Conference Sectional Meeting, Basle, 1926." Distinction is made between: Papers contributed by authors in the different countries by request or on the initiative of the respective National Committees or of a member of the International Executive Council, World Power Conference (*National Papers*); and Papers prepared by general reporters appointed by the Swiss National Committee, containing a summary of all the national papers presented before April 1st, 1926, under the respective headings of the Technical Programme (*Reporters' Papers*). National Papers will be accepted for presentation to the Conference only when forwarded by a National Committee or by a member of the International Executive Council. Each country will present only one National Paper under each of the items A to E of the Technical Programme; these National Papers may be prepared by one or several authors. Official delegates to the World Power Conference are entitled to one copy each of papers which are of particular interest to them. Advance copies will be available for sale. All communications regarding the meeting should be addressed to the secretary as above.

Large Hydro-Electric Plant in Italy.—The De Bretto, Escher Wyss Co., of Schio, the Italian branch of the Swiss Escher Wyss Co., has just secured a contract for two vertical-shaft turbines which, it is claimed, will be the largest so far constructed in Europe. They are to develop 50,000 h.p. each under a head of 646 ft., and are intended for the new Galleto hydro-electric station on the River Velino of the Società Industria e Elettrica, of Terni, near Rome.

Bauxite in Montenegro.—According to a report from Cetinje, large deposits of bauxite have been discovered between Bar and Ulcin, and have already been investigated by the Vienna geologist, Herr Korner. The deposits are said to be similar to those in Hungary, and are estimated to represent 30,000,000 tons. The distance to the nearest port in the bay of Mrkovac is 5.5 miles. It is stated that a Splitler firm has provisionally obtained working rights, although negotiations are pending with French and German firms for the opening up of the deposits on a large scale.

Electric Furnaces in France.—Dealing with the progress of electrometallurgy in France, a Paris journal points out that most of the electric furnaces in use in that country for such purposes have a capacity of from 2 to 3 tons, although some of recent types have a capacity up to 15 tons. In 1913 there were 24 furnaces in operation for the manufacture of steel, the production in that year having amounted to 21,124 tons of ingots and castings and 11,700 tons of finished products. The number of furnaces which served for the manufacture of ferro-alloys was much greater and their output amounted to about 30,000 tons. At that time the electrometallurgical industry comprised 12 companies with a share capital of 41,600,000 fr. The annual production for French consumption was about 3,000 tons of ferro-silicon of from 25 to 90 per cent., but calculated at 50 per cent., and that of ferro-tungsten amounted to 250 tons. In the meantime development which has taken place has brought the number of companies up to 22, of which a certain number produce both ferro-alloys and carbide of calcium. Most of these undertakings are situated in the region of the Alps (Isere, Savoie, and the Dauphine), where they are grouped in those districts wherein the use of water power has been the most developed; but they are too distant from seaports for the import of raw materials as well as from the chief centres of consumption. During 1924 the manufacture of ferro-silicon alone absorbed over 100,000,000 kilowatt-hours, corresponding to a production of more than 13,000 tons of this alloy. The production of ferro-manganes in the electric furnace in 1924 ranged from 20,000 to 30,000 tons. Among other products are mentioned ferro-chrome, silico-managanese, and ferro-tungsten. In the case of carbide of calcium it is stated that the production in electric furnaces only reached 31,500 tons in 1913, but increased to over 110,000 tons in 1924. Of this total a quantity of 40,000 tons was used for autogenous soldering, 20,000 tons for fixed and portable lighting, 38,000 tons was converted into cyanamide and 10,000 tons used for chemical purposes.

Electricity in Mines.—SPANISH COMPETITION.—The Mines Department of the Spanish Government has recently issued particulars of a competition, open only to Spanish engineers and in respect of which a first prize of 8,000 pesetas is offered together with two second prizes of 2,000 pesetas each, for the best outline of a modern electrical installation for mines, embracing extraction, ventilation, traction below ground, mechanical preparation, &c. The competition will remain open until March 15th next.

High-frequency Rays.—In *Nature* of December 5th, an address delivered by Dr. R. A. Millikan, before the National Academy of Sciences, Madison, U.S.A., on "High-frequency Rays of Cosmic Origin," was reproduced. The author stated that in 1903 the British physicists Rutherford and McLennan noticed that the loss of charge of an electroscope in an air-tight chamber could be reduced by enclosing the whole in a completely encircling metal shield a centimetre thick, showing that the leakage was not due to imperfect insulation but to highly penetrating rays which could pass through the shield and ionise the gas inside the chamber. The rays were at first attributed to radioactive materials, but in 1910 it was found that the radiation did not decrease rapidly with altitude, and German physicists reported in 1912-14 that it greatly increased at a height of 9 km.

After the war Dr. Millikan and Mr. I. S. Bowen sent up balloons containing recording instruments to a height of 15.6 km. (nearly 10 miles) and proved conclusively that the "penetrating radiation" was greater there than at the earth's surface. In 1923 Dr. Russell Otis and Dr. Millikan went to the top of Pike's Peak, and made further experiments; and in the summer of this year Mr. H. Cameron and the author ascended to Muir Lake, 11,800 ft. high, at Mount Whitney, where they sank their electroscopes to various depths down to 60 feet. Their experiments left no doubt that the rays could penetrate the water to a depth of 45 feet, and as the atmosphere above the lake had an absorbing power equivalent to 23 ft. of water, the total penetration was equal to 68 feet of water, or 6 feet of lead. The most penetrating X-rays cannot go through half an inch of lead. High penetrating power means high frequency, and according to a formula valid with longer waves, the wave-length of the shortest waves the experimenters discovered was 0.0004 Angstrom, or one-fiftieth of that of the hardest gamma rays previously known; the longest was 0.00067 Angstrom. Their conclusions were accurately verified at another lake. The author suggested that the rays were due to nuclear transformations of some sort, enormously more energetic than those taking place in any known radioactive changes. They come to the earth with equal intensity from all directions by day and night.

Discussing these observations in a letter to *Nature* of December 12th, Dr. J. H. Jeans suggested that the radiation was generated by quanta of wave-length 1.3×10^{-13} cm., each quantum being produced by the simultaneous destruction of one electron and one proton. Such newly generated energy could escape from the transparent nebulæ into space, and its penetration into our atmosphere would seem to provide a natural explanation for the radiation investigated by Millikan. The high-frequency radiation from the great nebula in Andromeda alone would contain sufficient energy to produce about one-half the observed ionisation. After showing that the radiation produced on this hypothesis would have properties corresponding to those observed, Dr. Jeans concludes that "the bombardment by these rays provides an obvious explanation of the luminosity of such objects as the irregular nebulæ, as well as of the negative charge of the earth."

"Linaludo." — This is the name of a game, requiring much time and a good deal of patience, which has been produced by Mr. Archibald Sharp, B.Sc., A.M.Inst.C.E., F.C.I.P.A. It is based on the knight's move in chess, the idea being to touch upon each of a set of squares once only, and, if possible, to complete a circuit or "grand tour." The game is published by Messrs. E. Marlborough & Co., Ltd., at 4s.

Coal Commission.—Giving evidence before the Coal Commission on December 9th, Mr. Edmund Hann discussed with Mr. Evan Williams the subject of electricity supply to collieries, and is reported by the *Financial Times* to have expressed the belief that it was cheaper to transport coal than to transmit electricity over routes in excess of three miles.

Visit to Power Station.—On December 3rd members of the Taunton Traders' Association paid a visit to the borough electricity works, being conducted round the station by Mr. A. J. Howard, the borough electrical engineer, and his assistants. The invitation to view recently-installed machinery was extended by Ald. J. E. Kingsbury, the chairman of the Electricity Committee.

Appointments Vacant. — General fitter (£400), for the Government of the Gold Coast; electrical inspector (£600) for the Government of Nigeria; engineer clerk of works, for the Peterborough Corporation Electricity Department; junior shift engineer or improver for the Horsham U.D.C. Electricity Works; assistant in Mains Department for the Wolverhampton Corporation Electricity Department; electrical engineer (£480) for the Government of Nigeria Public Works Department. (See our advertisement pages to-day.)

The Electroplaters' and Depositors' Technical Society.—The first business meeting of this new Society was held at the Northampton Polytechnic Institute on December 9th, when Mr. S. Field delivered an address on the above subject as an introduction to the work of the session. Prof. F. G. Donnan, president of the Faraday Society, was in the chair. Mr. Field ascribes recent progress to the growing recognition among practical platers, of the inadequacy of rule-of-thumb methods, and to the consequent desire to found the art on sound scientific knowledge. Another factor, he says, has been the increasing applications of electrodeposition in many fields of industry, even in engineering practice. The day has passed when electrodeposition included nothing but silver and nickel plating and electrotyping, and we now have zinc, tin, lead, iron, cobalt, cadmium, and chromium, being commercially deposited. In other directions copper matrices are being deposited as moulds for gramophone records, and copper is also being deposited as wire for the prevention of carbonisation and in the manufacture of copper water-jackets. Iron and nickel are being deposited in the repair of iron parts of machinery, while cadmium is being used as a substitute for zinc in protecting against sea-water and similar corrosion. It is probable that chromium plating will become fairly general to render iron and steel non-corrodible, although the practical difficulties in the deposition of this metal call for care and knowledge.

Many problems remain to be solved. In the actual processes may be mentioned such difficulties as spotting-out, the appearance of pin-holes, and the exfoliation of deposits. Indeed, the whole subject of the relation between the mechanical properties of deposited metals and the constitution of the electrolytes used calls for systematic examination. What is it that conditions the adhesion of a deposit; what is the effect of neutral salts in solution, and why do colloidal additions in minute quantities have so extraordinary an effect on the properties of the deposit? There is obviously room for organised co-operative research in this branch of technology, and it is gratifying to learn that the Department of Scientific and Industrial Research has made a beginning in initiating such work at Woolwich and elsewhere. Finally, Mr. Field deals with the possibilities of standardisation in the electroplating industries, both as regards language and methods. May it not be possible, by means of concerted effort, to replace the multitudinous so-called formulæ now in use by a comparatively few and reliable compositions? It is evident that the new Society responds to a real need, and if by its discussions it leads to organised efforts in carrying out fundamental research, it will have performed a real service to a not unimportant branch of the electrical industry.

Roedean Schools Installation.—Since the publication of the reference to the recent electrical installations at the Roedean Schools, Brighton, in our issue of December 4th, we have been informed that "Walsall" metal-sheathed wiring fittings supplied by the Walsall Hardware Manufacturing Co., Ltd., were employed throughout the entire installation.

Road Surface Traffic Guide.—We are asked to state that the correct title of the firm responsible for the electrical installation in the "Illuminated White Line," described in our issue of December 4th, under the above heading, is British Electrical Installations Co.

Miners' Electric Lamps in France.—At a recent meeting of the Northern Section of the French Société de l'Industrie Minerale, M. Soulary read an interesting paper on the experience of the use of miners' electric lamps in the collieries of the Compagnie des Mines de Bruay, in the Pas de Calais Department. So satisfactory have they been that the company has now over 14,500 such lamps in use and is only retaining a sufficient number of oil lamps (about 2,700) to meet legal requirements.

The batteries are charged in groups of 100, a method which simplifies the electrical connections, and prevents any waste of current. No battery repairing is undertaken in the charging department, any accumulators which need repair being dealt with in a special shop. M. Soulary stated that, not only have the electric lamps proved successful, but they are also found to be more economical, their adoption by the company having resulted in an annual saving of about 800,000 francs. The increased use of electric lamps at the Bruay mines has enabled a reduction in the lamp trimming staff to be effected. Thus, whereas out of 13,110 lamps in use in June, 1922, only 6,316 (or about 48 per cent.) were electric, while 6,794 (or 52 per cent.) were oil, the total is now 17,172, of which the electric lamps' share is 14,431 (or approximately 84 per cent.) and the oil lamps' share 2,741 (16 per cent.). During the same period, notwithstanding an increase of 30.9 per cent. in the number of lamps, the number of trimmers required has fallen from 229 to 156, a drop of 31.8 per cent.; in other words, each man is now able to look after 110 lamps, as against only 58 when oil lamps preponderated.

The Electric Vehicle Committee of Great Britain.—RECONSTRUCTION OF COMMITTEE.—The Electric Vehicle Committee, formed in 1913 under the auspices of the Incorporated Municipal Electrical Association, has for some years been associated with the British Electrical Development Association. At a meeting held on June 20th, it was resolved to reorganise its constitution by forming a "Main Committee" representative of all interests concerned in the electric vehicle business, and composed of persons nominated by the various associations (or individually elected, where necessary); the Main Committee is to elect its chairman and to appoint a small Executive Committee. The former will meet quarterly, the latter monthly.

Starting from November, 1925, the following will hold office till March, 1927: Chairman, Mr. J. A. Priestley; vice-chairmen, Messrs. A. J. Makower and W. B. Worby Beaumont; hon. treasurer, Mr. J. Christie; past chairmen, Messrs. F. Ayton and R. A. Chattock.

The Main Committee includes representatives of nineteen societies or groups, of which the I.M.E.A. and the makers of electric vehicles have the largest numbers (7 and 6 respectively); the Committee when fully constituted will comprise 44 members. The Executive Committee consists of Messrs. A. C. Cramb, A. W. Blake, F. E. Gripper, F. W. Crawter, E. W. Curtis, F. Ayton, R. J. Mitchell, A. J. Makower, J. B. Osler, J. A. Priestley, and Col. R. E. Crompton.

We hope that the Electric Vehicle Committee, of which little has been heard for some years, will now enter upon a new era of well-directed activity. There is abundant scope for its labours.

Diesel-Electric Railway Traction.—With further reference to the note on the above subject on page 943 of our December 11th issue, our attention has been drawn to the fact that the electrical system adopted for the smaller of the two types of car in use on the Canadian National Railways was developed by the General Electric Co., of America, and carried out by the British Thomson-Houston Co., Ltd. It involved the design of generators having a special characteristic, with the object of eliminating control resistances and thereby saving space and obtaining higher running economy, which is of a substantial order, particularly over routes that include gradients, &c., and necessitate a large torque at a low speed for an appreciable proportion of the running time.

The main generators are designed for a speed of 700 r.p.m. and a terminal pressure of 600 volts, and are rated at 105 kW for two hours, with a temperature rise not exceeding 50 deg. C., or 85 kW continuously, with a temperature rise not exceeding 40 deg. C. On test, temperature rises were very low, and it was found that the machines were capable of an output of 105 kW continuously without dangerous heating. The exciters are shunt wound and of the overhung type, the frames being supported from the main generator end shields and the armatures carried on extensions of the main generator shafts; they are rated at 6 kW at a terminal pressure of 60 volts. A 16-cell battery of 450 ampere-hours capacity, which is charged by the exciter during the running periods, is provided for lighting, starting, and supplying power for contactor-closing coils, &c.

The main generators are provided with three windings on the main poles:—(*a*) A shunt winding separately excited from the exciter, (*b*) a winding connected in series with the battery across the exciter terminals, and (*c*) a differential series winding carrying the line current of the generator. By means of this combination, an extremely drooping volt-ampere characteristic is obtained which causes the demand for power from the engine over the working range to be substantially constant; on high gradients the torque required from the driving motors demands a heavy current from the generator, but as this is associated with a comparatively low voltage, there is no likelihood of stalling the engine. The engine is started up by means of a series-wound motor capable of exerting a torque equivalent to 45 h.p. at 200 r.p.m., and supplied from the battery, or alternatively, by means of the starting engine. The main driving motors are of the railway type, and can be connected in series or parallel by means of a controller of the usual traction type. There are no losses in starting and regulating resistances as the supply voltage, and therefore the speed, is controlled by the main engine throttle.

Science and Business.—Mr. A. P. M. Fleming, head of the Department of Education and Technical Research of the Metropolitan-Vickers Electric Company, delivered a lecture last week at the London School of Economics, under the auspices of the Commerce Society, on the subject of "Science and Business." He said, according to the *Financial Times*, that there was no industrial country in which there appeared to be such a lack of understanding between science and business as in Great Britain. Yet the scientist could not exist without the labours of the business man, and, on the other hand, no industry could make progress without continuous application of new scientific knowledge. Practically every phase of civilised life depended on the use of power. In this country we employed much less power than certain other industrial countries. This condition was changing, and it seemed likely that in the near future, with the interlinkage of electrical power systems, we might have power available under sufficiently economic conditions to extend its use very considerably. One of the problems of the future, and one on which civilisation would ultimately depend, would be the question of suitable electricity supply. It was increasingly necessary in this country to have a strong public well informed of the need for science and its underlying importance in all our business and national life.

Institution Notes.

Institution of Electrical Engineers.—INFORMAL MEETING.—On Monday, January 11th, 1926, at 7 p.m., a discussion on "The Electrical Installation at the Rockefeller Building, University College," will be opened by Mr. W. C. Clinton, B.Sc. On this occasion the meeting will take place at University College, Gower Street, London (refreshments at 7 p.m.). The X-ray and dissecting rooms and the library and museum of the Rockefeller Building will be open for inspection. The nearest stations to the College are:—Warren Street and Goodge Street (Hampstead Tube), and Euston Square (Metropolitan Railway).

At the informal meeting on Monday, December 7th, with Mr. P. Dunsheath, O.B.E., in the chair, Mr. C. L. Lipman opened a discussion on "The Design and Performance of Protective Relays." The opener showed a large number of lantern slides illustrating the operation and range of relays for all duties, and several types of the instruments described were on exhibition.

Dr. R. D. Gifford remarked that one of the great difficulties of the designer arose from the tendency of voltages to increase; with the consequent fall in current, transformers were almost at their winding limits.

Col. K. Edgcumbe said that in the United States, where until quite recently it was the practice to scoff at relays, they were now very much used and the larger supply authorities employed a "relay engineer," whose duty it was to inspect and maintain the automatic protective devices.

Mr. J. F. Shipley said that within the limits of reliability and safety there was no need for the expensive finish that was customary in English instruments. He had found in the United States that they were buying from the Continent in large numbers a robust type of relay with overload and inverse-time-limit features which cost considerably less than the highly-finished British article.

Many other members took part in the discussion.

IRISH CENTRE.—The advantages of harvesting peat by machinery was the subject of an interesting lecture on December 10th by Mr. James Lindsay in Dublin. He dealt in detail with the success of machinery driven by electricity generated from peat in the Turrann bogs in the King's County, and emphasised the importance of drainage to facilitate the setting up of plant on the bogs. Prof. Purcell paid a tribute to Sir John Griffith for the time and money that he had expended in endeavouring to make the peat industry the profitable undertaking it might easily be for all who were engaged in it.

SCOTTISH CENTRE.—At a joint meeting of the Scottish Centre of the Institution of Electrical Engineers and the Association of Mining Electrical Engineers (West of Scotland branch) in Glasgow on December 8th, a paper on "Electricity in Mines" was read by Major E. Ivor David. Dr. Magnus Maclean presided.

Junior Institution of Engineers.—On Friday last week Mr. J. S. Highfield, M.Inst.C.E., M.I.E.E., was inducted to the presidential chair by the retiring president, Dr. Alexander Russell, M.A., and delivered his inaugural address, which will be abstracted in our pages.

Institution of Mechanical Engineers.—In a paper on "Foundry Practice," read before the above Institution on December 11th, Mr. J. G. Pearce, B.Sc., said that to-day cast iron was regularly produced in foundry cupolas from a wide variety of raw materials with great consistence and economy. Certain applications which had temporarily been usurped by steel and other materials were reverting to cast iron, and in some developments, notably in internal combustion engineering, the development of the material was keeping pace with the growing demands of the designer. A paper was also presented by Mr. J. E. Fletcher on "Some Applications of Research to Modern Foundry Practice," in which he gave in detail some examples of the type of work and methods of attack used in applying the results of research in the foundry.

Institution of Production Engineers.—At a meeting held on December 16th, Mr. A. H. Mundey delivered a lecture on "Die-Casting."

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Mr. E. W. ANDREWS, who has completed 25 years as head of the Sunderland branch of Messrs. F. Reid, Ferens & Co., of Newcastle-on-Tyne and Sunderland, has been presented by the workmen and officials with a combination cabinet. The workmen and apprentices of the Sunderland branch presented Mrs. Andrews with a silver trinket basket.

Reading Town Council has decided to increase the salary of the general manager and engineer of the tramways, Mr. CALDER, from £800 to £900 per annum, without bonus.

According to the *Australasian Electrical Times*, Mr. R. H. BARTLEY, chief engineer of the Auckland Electric Power Board, has been appointed to the position of general manager at a salary of £1,100 a year, and Mr. A. O. GLASSE has been appointed chief engineer in succession to Mr. Bartley.

Mr. H. KITCHEN, M.I.E.E., was entertained by his colleagues in the Northern Engineering District of the Post Office at the Central Exchange Hotel, Newcastle-on-Tyne, on Saturday, November 28th, when he was presented with a gentleman's wardrobe, on the occasion of his promotion to the position of assistant staff engineer, London. The gathering was representative of all ranks in the district. The chairman, Mr. J. R. M. Elliott, M.I.E.E., superintending engineer, in making the presentation, said that Mr. Kitchen was captain of the rifle team before the war, and he registered the highest score when Major O'Meara's cup was won by the district. He is a member of the Institution of Electrical Engineers, and for some years lectured on technical subjects at Rutherford College, Newcastle, and at Jarrow Technical School. He had always manifested a keen interest in the work and activities of the Institution of Post Office Electrical Engineers, and for a period of three years served on the main Council of the Institution.

Capt. H. SAUNDERS-JACOBS has been appointed assistant director of the Sheffield relay station of the B.B.C. After war service he was a member of the Military Inter-Allied Commission of Control in Germany from 1920 to 1922. He took a science degree at London University.

At the annual dinner of the Merthyr Electric Traction and Lighting Co., Ltd., held at Merthyr on December 3rd, Mr. F. J. Cursons, secretary of the company, presiding, Mr. LEWIS W. DIXON, the managing engineer, was presented with a solid oak writing table. It had been subscribed for by the staff and employés as a token of appreciation. Mr. Edward Rowlands, the chief clerk and cashier, who made the presentation, proposed the toast, "Our Chief," and in doing so referred to the growth of the business from small beginnings to its present operations supplying electricity over an area of nearly 30 square miles—but with the heavy burden of £6,000 per annum in rates! Mr. Dixon, who responded, has been manager of the company for 18½ years.

Shoreditch Borough Council Law and Establishment Committee recommends that Mr. C. NEWTON RUSSELL, the borough electrical engineer, be granted a retiring allowance of £510 as from December 19th, 1925 (the six months' extension of service expires on December 19th).

The fiftieth anniversary of the day on which Dr. H. A. LORENTZ took the degree of Doctor of Physical Science at the University of Leyden, was celebrated at Leyden last week, many noted scientists being present for that purpose, besides the Queen of Holland and the Acting Prime Minister, Mr. Colyn.

Obituary. — We are sure that many of our readers will desire to associate themselves with us in an expression of deep sympathy with Mr. HOWARD FOULDS, F.C.I.S., the secretary of Callender's Cable & Construction Co., Ltd., on the death of his wife, who passed away, after a long illness, at "Littlecomb," Caterham Valley, Surrey, on December 9th.

MR. A. P. BOLGER.—The death took place on December 8th, in his 57th year, of Mr. Alfred Patrick Bolger, who was a departmental manager at the works of Crompton & Co., Ltd., of Chelmsford. He had been with the firm for 31 years, and was formerly at the London office.

New Companies Registered.

Scientific Products, Ltd. (210,205). — Private company. Registered December 7th. Capital, £500 in 5s. shares. Objects: To carry on the business of scientific instrument manufacturers, factors and merchants, manufacturers of wireless apparatus, &c. The first directors are:—E. H. Newman (permanent), 237, Uxbridge Road, W.12; A. Grigg, 237, Uxbridge Road, W.12. Remuneration as fixed by the company. Registered office: 88/90, Chancery Lane, W.C.2.

Gaston E. Marbaix, Ltd. (210,252).—Private company. Registered December 10th. Capital, £1,000 in £1 shares. Objects: To carry on the business of importers, exporters, manufacturers, assemblers, equippers and repairers of and dealers in all wireless and telephonic apparatus, valves, instruments, equipment and accessories, electrical, mechanical and general engineers, &c. The subscribers (each with one share) are:—G. E. L. J. Marbaix, 50, Leyland Road, Lee, S.E.15, merchant; W. L. Bibley, 36, Brambledown Road, Wallington, accountant. The first directors are:—G. E. L. J. Marbaix (permanent governing director), and such other persons as shall be appointed by him. Solicitors: Frank Simmonds & Carter, 98, Salisbury House, London Wall, E.C.2. Registered office: 27/28, Anning Street, E.C.

Exe Valley Electricity Co., Ltd. (210,235).—Public company. Registered December 9th. Capital, £6,000 in £1 shares (4,000 preference and 2,000 ordinary). Objects: To carry on at Bampton and elsewhere in the Counties of Devon and Somerset the business of an electric light company in all its branches; to acquire the benefit, rights, powers, authorities, obligations, and liabilities of J. A. Purves in and under two agreements (1) with the Urban District Council of Bampton and (2) with A. Scott; and a lease between George and V. J. Burrow of the one part and J. A. Purves of the other part and a special order to be made by the Electricity Commissioners and known as the "Bampton Electricity Special Order, 1925," which is being applied for by J. A. Purves. Minimum cash subscription, £1,500. The first directors are:—J. A. Purves, Thorpe Hall, Eaton Rise, Ealing, engineer; Margaret M. Partridge, 16, East Southernhay, Exeter; F. W. Wescott, 42, Brook Street, Bampton, baker; J. Seward, Newton Square, Bampton, baker; F. C. Davey, 15 and 17, Fore Street, Bampton, saddler; B. M. Read, Castle Grove, Bampton, retired colonial civil servant; D. E. Green, The Vicarage, Bampton, engineer (managing director for three years). Qualification, 50 shares. Remuneration of managing director, £150 for first year, £200 for second year, and £250 for the third year, and a percentage of the profits. Solicitors: Joyce, Risdon and Hosegood, Williton, Taunton. Registered office: 27, Brook Street, Bampton, Devon.

R. R. Goding, Ltd. (210,116).—Private company. Registered December 5th. Capital, £3,000 in £1 shares. Objects: To acquire the business carried on at 42, Gray's Inn Road, W.C., as the National Wireless and Electric Co., to adopt an agreement with R. R. Goding, and to carry on the business of manufacturers of, and dealers in wireless and electrical goods, wireless, electrical, mechanical, and general engineers and contractors, &c. The directors are:—R. R. Goding, 20, Chatsworth Gardens, Acton, W.3, wireless engineer (permanent managing director); A. N. Entwistle, West View, West Moors, Dorset, wireless engineer. Qualification, 50 shares. Remuneration as fixed by the company. Secretary: A. N. Entwistle. Registered office: 42, Gray's Inn Road, W.C.1.

Jemco, Ltd. (210,197).—Private company. Registered December 7th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers of insulated and other wire, cables, and all electrical apparatus and appliances, electrical and general engineers, &c. The first directors are:—Mrs. Mary C. Smith, Stowfield House, Lydbrook, Glos.; Miss Muriel C. Smith, Stowfield House, Lydbrook, Glos. Qualification, £25 shares or stock. Remuneration (if any) as fixed by the company. Solicitors: Rooke & Sons, 45, Lincoln's Inn Fields, W.C.2. Registered office: Lydbrook, Glos.

British Hard Rubber Co., Ltd. (210,166).—Private company. Registered December 5th. Capital, £6,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in hard rubber, ebonite, vulcanite and any other plastic substances or compositions and articles made therefrom; chemical, textile, electrical, mechanical and general manufacturers and engineers, manufacturers of and dealers in radio and electrical instruments, &c. The subscribers (each with one share) are:—Joan Peachey, 9, Hetley House, Hetley Road, W.12, stenographer; V. Deighton, 97, Junction Road, Highgate, N.19, solicitor's clerk. P. E. Wells is to be one of the first directors and shall be permanent chairman. Qualification of first directors, 1 share; of other directors, 100 shares. Solicitors: A. Blackman, Hailey & Co., Gresham House, Old Broad Street, E.C.2. Registered office: Wharf Road, Ponders End, Middlesex.

Milton and Barton-on-Sea (Hants) Electrical Supply Copany, Ltd. (210,162).—Public company. Registered December 5th. Capital, £15,000 in £1 shares. Objects: To carry on at Milton and Barton-on-Sea, in the Rural District Council of Lymington, Hants., the business of an electric light company in all its branches, and to adopt an agreement with A. R. Musgrave for the carrying out of an order made by the Electricity Commissioners under the Electricity (Lighting) Acts, 1882-1923 in respect of the parish of Milton, for taking a transfer of an undertaking and the said order. Minimum cash subscription, 10 per cent. of the amount offered. The directors are:—A. R. Musgrave, Grove Lodge, Isleworth, Middlesex, soap manufacturer; Mrs. Margaret A. Musgrave, same address. Qualification, 500 shares. Remuneration as fixed by the company. Secretary: Mrs. M. A. Musgrave. Solicitors: Moore, Vicary & Trestrail, 38, High Street, Lymington and New Milton. Registered office: Milton, Hants.

James & Venables, Ltd. (210,265).—Private company. Registered December 10th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of manufacturers of, and dealers in wireless products of all kinds, speedometers, clocks, brake and clutch linings, motor accessories, tobacco, cameras, and fancy goods, &c. The directors are:—E. H. Cully, 3, The Drive, Hove, Sussex; W. O. Carroll, 12, Great Queen Street, W.C.2. Qualification, 1 share.

Official Returns of Electrical Companies.

W. R. Harding & Co., Ltd.—H. J. Herbert, of 172, Bishopsgate, E.C.2, was appointed receiver and manager on November 21st, under powers contained in debenture dated June 12th, 1925.

New System Private Telephone Co., Ltd. (73,732).—Capital, £20,000 in £1 shares. Return dated May 5th, 1925. 15,000 shares taken up. £13,000 paid. £2,000 considered as paid. Mortgages and charges, nil.

Modern Electrical Supply Co., Ltd.—F. S. Wilks, of 31, Lombard Street, E.C.3, ceased to act as receiver or manager on November 30th, 1925.

Rowland Edwards & Co., Ltd.—Debenture dated November 30th, 1925, to secure £600, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. B. K. Sharman, 51, Madrid Road, Barnes.

Church Stretton Electric Supply Co., Ltd.—Satisfaction to the extent of £250 on October 20th, 1924, to the further extent of £250 on May 12th, 1925, and to the further extent of £250 on November 13th, 1925, of charge dated January 29th, 1921, securing £1,550.

Auto Welding and Engineering Co., Ltd.—A. H. P. Howard, of 46, Peartree Street, Goswell Road, E.C.1, ceased to act as receiver or manager on November 13th, 1925.

Harry Morser & Company (Wireless), Ltd.—Debenture dated November 30th, 1925, to secure £1,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: H. W. D. Gallwey, Winchester House, Kingston Hill, Surrey.

Betax Manufacturing Co., Ltd.—Debenture dated November 16th, 1925, to secure £2,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Ben Tax, 21, St. Vincents Road, Westcliff-on-Sea.

Eclat Electric Manufacturing Co., Ltd.—E. M. Carrington, F.C.A., of 2, Gresham Buildings, Basinghall Street, E.C.2, ceased to act as receiver and manager on November 30th, 1925.

R. M. P., Ltd.—Mortgage debenture bond, dated November 27th, 1925, to secure £307, charged on the company's undertaking and property, present and future. Holder: G. P. Power, Adderley Road, Saltley, Birmingham.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Foundation Co., Ltd.

The annual meeting of this company was held on December 9th, Mr. A. W. Tait, C.B.E., presiding. In presenting the report and accounts the chairman made mention of a number of important contracts which had been entrusted to the company. During the year the principal contracts obtained were:—The City and South London Railway extension to North Morden; escalators at Tooting, South Wimbledon, and Colliers Wood; transmission lines for the North Wales Power Co.; mast foundations for the Marconi Co. (Australia); and tramway construction for the Melbourne Tramways Board. Work was also in hand for the following:—The London Electric Supply Corporation, Deptford; the Yorkshire Electric Power Co., Ferrybridge power station; the Borough of Woolwich; the South Wales Power Co.; and the Mid-Cheshire Electric Supply Co. An arrangement had been made with the parent company for direct participation and incidental assistance in contracts obtained by that company and its associates in Europe, Asia and Africa, other than British territory. For the purpose of assisting in the finance of contracts in the territory referred to a new company had been formed in America with a paid-up capital of $3,000,000. The parent company had also recently increased its capital by $1,200,000. The company itself intended to raise its capital from £250,000 to £350,000 by the creation of ordinary £1 shares, ranking *pari passu* with the existing ordinary shares. The business was satisfactory and they hoped that it would continue to expand and that its connections would increase. The report and accounts were adopted and at a subsequent extraordinary meeting the proposed increase in the company's capital was approved.

The Vickers Reorganisation Scheme.

Last week the advisers appointed by Vickers, Ltd., to inquire into the company's affairs and make recommendations regarding reorganisation (Mr. Reginald McKenna, Mr. F. Dudley Docker, and Sir William Plender, Bart.) made a lengthy report, which the board has endorsed, and it is intended to carry the recommendations into effect. The investigators found that the earning capacity of the company and its allied undertakings had greatly decreased in recent years and that it appeared unlikely that the position would improve sufficiently to allow of the payment of dividends on the existing ordinary share capital. It was also found that the value of many of the assets was considerably below the figures at which they stood in the company's accounts. The company was also under heavy contingent liabilities for which no specific provision had been made and might be expected to result in actual liabilities upon the company. It is therefore recommended that the ordinary share capital be written down from £12,315,483 to £4,105,161 (*i.e.*, the £1 shares will be reduced to 6s. 8d.); that £3,600,000 be appropriated from the reserve fund; and that £632,044 be appropriated from the balance standing to the credit of the profit and loss account. This sum (£12,442,366) will be utilised in writing down the land, buildings, &c., by £4,254,994; the book value of the company's interest in subsidiary companies by £5,488,316; and the book value of the marketable securities, &c., in hand by £472,150; the balance (£2,271,906) will be used to create a reserve to meet contingent and other liabilities not provided for. The causes of the company's loss are stated to have been:—(*a*) The general depression in trade; (*b*) Depreciation in foreign exchanges; (*c*) Reduced earning capacity attributable to: (1) The world reduction in armament expenditure; (2) the home production of armaments by foreign countries; (3) the decline in shipbuilding; (4) foreign competition in world markets; and (5) financial stringency and political unrest in Europe, which has restricted the giving of credit and retarded schemes of development. Other causes of a different nature which have contributed to the position are the lack of special experience in the management, necessary to control so large and varied a body of industrial undertakings; and the entering into investments which have not only proved unremunerative but are now the subject of considerable liability. It is therefore proposed that some of the present directors should retire to provide vacancies on the board for new members. It is recommended that, in addition to the reconstituted board of directors, there should be three management boards, *viz.*, an industrial board; an armaments and shipping board; and a finance board. It is suggested that the remuneration of the directors should be limited; that superfluous officials should be discharged; that all unremunerative subsidiaries should be wound up, &c. The principal subsidiaries are the Metropolitan Carriage, Wagon and Finance Co. and the Metropolitan-Vickers Electrical Co., Ltd., both of which have been profitable. Other electrical (or partly electrical) concerns in which the company is interested are Vickers-Petters, Ltd., the British Lighting & Ignition Co., Ltd., W. T. Glover & Co., Ltd., the Ioco Rubber & Waterproofing Co., Ltd., Electric & Ordnance Accessories, Ltd., and Adam Hilger, Ltd. In accordance with the request of the board, Messrs. McKenna and Docker, and Sir Wm. Plender have agreed to continue to act in a consultative capacity until the board has been reconstructed and the three suggested boards are functioning. The directors point out that while the proposed reduction of capital is drastic, it is in effect only a book entry and each ordinary shareholder will continue to hold exactly the same *pro rata* interest in the company which he now holds.

An extraordinary general meeting was to be held yesterday (Thursday) at Sheffield to give effect to the recommendations. It was to be proposed that the capital should be reduced from £26,500,000 to £18,289,678 by cancelling paid-up capital to the extent of 13s. 4d. on each of the existing 12,315,483 ordinary shares, and that each of the 5,684,517 unissued ordinary shares should be subdivided into three shares of 6s. 8d. each.

French Companies.

The *Société d'Applications Industrielles* (*Compagnie d'Entreprises Electriques*), of Paris, earned net profits of 4,278,000 fr. in 1924-25, and has declared a dividend at the rate of 12 per cent.

The *Société des Etablissements de E. C. Grammont et de Alex. Grammont* reports gross profits amounting to 21,746,000 fr. for 1924-25 as compared with 17,713,000 fr. in the previous year. It is proposed to apply the net profits to writing off various amounts, whereas in 1923-24 a dividend at the gross rate of 6 fr. per share was distributed.

The *Compagnie des Exploitations Electriques* states that the net profits increased from 1,405,000 fr. in 1923-24 to 1,943,000 fr. in 1924-25, and the dividend is at the rate of 17.50 fr. per share on share capital of 25,000,000 fr., as compared with the same rate on 18,000,000 fr. in 1923-24.

Austrian Company.—The report of the Oester. Siemens Schuckert Werke, for 1924, which has only just made its appearance, complains of lower sales caused by the economic crisis and the high taxes and social burdens. The absence of adequate orders to permit of the mass production of motors and other electrical goods was partly compensated for by the large orders for hydro-electric plant and electric railway equipment, and these orders have again been considerable in the current year. The net profits in paper crowns in 1924 were twice the amount of those in the previous year, and the rate of dividend rises from 2,000 crowns per share in 1923 to 4,000 crowns last year.

Dutch Company.—PHILIPS' LAMP WORKS.—The *Financial Times* correspondent at Amsterdam reports that the company is issuing 3,500,000 ordinary and 1,125,000 preferred shares, at 150 and 110 per cent. respectively, to present shareholders. This raises the capital of the company to 17,500,000 guilders in ordinary shares and 5,625,000 guilders in preferred shares.

British Columbia Electric Railway Co., Ltd.—The report for the year ended June 30th last shows a profit of £360,792, after providing for debenture interest, &c. Final dividends at the rate of £2 9s. 3d. on the preferred ordinary shares (making £6 6s. 9d. per cent.) and at the rate of £4 2s. 6d. on the deferred ordinary shares (making £8 per cent.), all free of tax, are recommended. The meeting is to be held on December 23rd.

Victoria Falls & Transvaal Power Co., Ltd.—The directors have declared a dividend of 3 per cent. for the half-year ending December 31st, and a further dividend of 3 per cent. in respect of participating rights for the year ending December 31st, on the preference shares. A dividend of 3 per cent. has also been declared on the ordinary shares.

Armstrong, Whitworth Development Co., Ltd.—Out of profits of £97,152 for the year ended September 30th last the company is paying a dividend of 15 per cent., free of tax, on the ordinary shares (as in 1923-24) and carrying forward £31,291, as compared with £11,640 brought in.

Manila Electric Corporation.—The financial Press reports that there is growing opposition to the offer of the Associated Gas and Electric Co. to exchange its 6½ per cent. obligations for Manila shares.

Power-Gas Corporation, Ltd.—There was a profit of £12,315 for the year ended September 30th last. The directors propose to transfer £2,000 to reserve, to pay a dividend at the rate of 4 per cent., and to carry forward a balance of £19,598.

Eastern Telegraph Co., Ltd.—A third quarterly interim dividend of 2½ per cent. on the ordinary stock, free of tax, is announced.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—A dividend of 5s. per share, free of tax, has been declared in respect of the quarter ended September 30th last.

W. & T. Avery, Ltd.—A half-yearly dividend at the rate of 5 per cent. has been declared on the ordinary shares.

Stocks and Shares.

MONDAY EVENING.

WITH Christmas so closely at hand, and with timorous apprehensions expressed about the Bank Rate, the Stock Exchange markets cannot expect to attract much business outside the area covered by the rubber share section. The rubber market remains remarkably active and tolerably strong. An occasional reaction may arouse the impression that the boom is over, and that quieter conditions are about to prevail, but the strength is quickly recovered, and prices go ahead again. This week's settlement in rubber shares is one of the heaviest on record, and money to pay for its purchases has to be found, to some extent, by the sale of securities elsewhere—a factor which adds a contributory cause to the reasons that make for dulness in other markets.

The electricity supply department is firm, the feature being a rise of 2s. 6d., to 60s. 9d., in County of London ordinary. Various rumours came into circulation to account for this, but the real reason has yet to be revealed, although it may be made public before these paragraphs appear. City of London lost 1/16 of their last week's advance; otherwise, the prices are good. Buyers of the shares frankly admit that they desire to discount the day of distribution of capital reserves. The cautious observer may deem this as, possibly, premature. He would urge that it might be well to await some definite indication of the manner in which the reserves are to be valued. However, the investor evidently considers that the outlook is sufficiently assured to justify him in the present purchase of shares in this list, and prices are hard in consequence of a persistent demand.

Brazilian Tractions stand out with a gain of 7 points, on the increasing favour with which the company's prospects are regarded. Brazilian tramway issues have not changed to any material extent. An interesting issue was made in New York last week, when ten million dollars of 6½ per cent. gold debentures in the Allgemeine Elektricitäts Gesellschaft, were offered at 94. Allowing for redemption in 1940, the yield at this price is 7¼ per cent. on the money.

Victoria Falls Power shares gave way upon news of an explosion having occurred on the property, but the decline was recovered upon declaration of an interim dividend on the preference shares at the same rate as that of last year. The price is now 33s. 9d., and the ordinary are quoted at 52s. Two of the company's machines were quickly restarted, thus ensuring a normal supply of power to the mines for 18 hours a day.

Falls are marked against some of the cable and electrical manufacturing shares, but, on the other hand, a few improvements occurred. Telegraph Constructions gained 10s.; the price has barely moved throughout the recent period of rising prices in this market. Callenders have gone back to 3¼ and Electric Constructions to 1¾; Siemens drooped to 32s. English Electrics lost a trifle at 19s. 3d. Brush shares hold their gain at 26s. 3d., Edisons hardened to 9s. General Electrics fell 6d. to 23s 6d. Cromptons at 15s. are 1/16 up. International Automatics keep close to £2, and Automatic Telephones at 51s. 3d. have parted with 1s. 6d. of their recent jump.

Vickers announce a drastic scheme of reorganisation, the directors proposing to write off 13s. 4d. per share from the ordinary, and so to reduce these shares to the nominal value of 6s. 8d. each. The price promptly put on 1/16, strengthening to 8s. 1¼d., thanks to the hope that this plan, if carried through, may bring the shares within sight of a dividend once more. Nothing has been paid on them since May, 1923. Several other companies in this group are expected to follow suit.

United River Plate Telephones have gone up 3s. 9d., to 7 11/16, and the market is a hard one as a whole. Globe ordinary rose ¼, to 18½, Great Northerns fell back to 34. The wireless shares fail to make headway, or to attract public attention. Marconis are 22s. 6d. and Canadians 5s. As previously noted, wireless shares have been turned out by some of the holders who wanted to exchange into rubber shares. The Marconi dividend time is approaching, and some nervousness is entertained lest the previous 10 per cent. may be cut in the forthcoming distribution.

Home Railway stocks are dull and uninteresting. Metropolitan slipped back a point to 69. This is the season at which, normally, investment takes a hand in the Home Railway market, but the public nowadays declines to evince any interest. The National Wages Board decision makes little difference to the position as it has been standing already.

British Insulated, ex rights, are nominally 17s. 6d. down: the value of the new shares makes up for the deduction. On the assumption that the 15 per cent. dividend will be maintained upon the increased capital, the yield on the shares now works out to a little under 5½ per cent. The rubber share market continues to absorb lively public interest. A disposition to take profits is, however, noticeable and the boom begins to look a little tired. The which is not altogether surprising, having regard to the furious pace at which the movement has proceeded during the past three months.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1923.	Dividend. 1924.	Price Dec. 14. 1925.	Rise or fall.	Yield p.c.
Bournemouth and Poole	1	18	14	59/9	—	4 14 1
Brompton Ordinary	1	10	10	1¾	—	*6 8 1
Charing Cross Ordinary	1	14½	15	2⅞	—	6 3 1
do. do. 4½ Pref	1	4	4½	17/6	—	5 2 10
Chelsea	1	12	12	2⅝	—	5 13 0
City of London	1	15	15	50/9	—⅛	5 18 1
do. do. 6% Pref.	1	6	6	22/-	—	5 4 4
Clyde Valley	1	8	8	29/6	—	5 8 6
County of London	1	15	15	60/9	+¼	4 18 8
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	7	24/-	—	5 16 8
do. 7% Pref.	1	6	7	21/6	—	6 10 8
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	14	15	13	—	5 15 5
Lancs. Light and Power	1	7½	7½	26/-	—	5 15 5
London Electric	1	10	10	34/-	—	5 17 8
do. do. 6% Pref	5	6	6	5⅝	—	5 6 8
Metropolitan	1	10	11	20/6	+1/-	5 11 6
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	22/9	—	5 5 6
Newcastle-on-Tyne Ordinary	1	6	7	22/6	—	6 4 6
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	24/6	—	5 14 3
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	15½	—	5 14 8
South London	1	15	15	2⅞	—	5 17 1
South Metropolitan Pref.	1	7	7	1¼	—	5 12 0
Urban Ordinary	1	4	4	18/3	—	4 7 8
do. 6% Pref.	1	6	6	19/9	—	6 8 1
Westminster Ordinary	1	15	15	45/6	+6d.	6 11 10
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	—	7 10 0
Yorkshire Elec.	1	8	8	30/6	—6d.	5 5 0

HOME RAILS.

Central London Ord. Assented Stock	4	4	67	—	5 19 5	
Metropolitan	,,	4	5	69	—1	7 5 0
do. District	,,	3½	3½	47	—½	7 9 4
Underground Electric Ordinary	10	Nil	Nil	2¼	—	Nil
do. do. "A"	1/-	Nil	Nil	7/-	—	Nil
do. do. Income Bonds	6	6	98	—	*6 2 5	

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref. Stock	6	6	103	—	5 16 6	
do. Def. ,,	1½	1½	24¾	—	6 0 8	
Automatic Telephone	1	8	6	51/3	—1/6	2 6 10
Chili Telephone	5	5	5	6⅛	—	*4 7 0
Cuba Sub. Ord.	10	5	5	6⅝	—	7 8 2
Eastern Extension	10	10	10	18	—	*5 9 7
Eastern Tel. Ord. Stock	10	10	10	177½	—	*5 12 8
Globe Tel. and T. Ord.	10	10	10	18½	+½	*5 8 1
do. do. Pref.	10	6	6	11	—	5 8 4
Great Northern Tel.	10	22	22	34	—½	6 8 6
Indo-European	25	7	8½	45¼	—	*4 13 5
Marconi	1	10	10	1¼	—	9 17 10
Marconi Marine	1	10	7½	8	—	8 11 6
Oriental Telephone Ord.	1	12	12	42/6	—	*5 13 11
United R. Plate Tel.	5	8	8	7 11/16	+3/16	5 4 1
Western Telegraph	10	10	10	17½ xd	+½	*5 12 6

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	9½	—	7 17 3
do. do. 2nd Pref.	5	6	6	8⅛	—	8 14 6
do. do. 5% Deb. Stock	5	5	73½	—1	6 16 3	
British Electric Traction Ord.	,,	6	6	120	—	5 0 0
do. do. 6% Pref.	,,	6	6	106	—	5 14 3
Brazil Traction	100	4	4	85	+7	4 14 2
Brit. Columbia Elec. Ry. Pcc. Stock	5	5	85½	—4½	5 17 0	
do. do. Preferred	,,	96/-	96/-	96½	—1	*4 19 5
do. do. Deferred	,,	120/5	120/5	115½	—	*5 12 7
do. do. Deb.	,,	4½	4½	76	—1½	5 11 10
Lond. & Sub. Trac. 5% Pref.	1	2½	Nil	4/-	—6d.	Nil
London United Tram. Deb. Stock	4	4	42½	—	9 8 4	
Mexico Trams, 5% Bonds	—	5	5	62½	—1	8 0 0
Mexican Light Common	100	Nil	Nil	31½	—	Nil
do. Pref.	100	Nil	Nil	61½	—	Nil
do. 1st Bonds	—	5	5	72	—	6 18 11
Yorkshire (West Riding)	1	5	—	18/9	—	5 6 8

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	12	51/3	—	*4 13 4
British Aluminium Ord.	1	5	10	38	—	5 5 3
British Elec. Transformer Pref.	1	Nil	7	1	—	...
British Insulated Ord.	1	15	15	2½xr	—	5 9 1
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	3¼	—⅛	4 12 4
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	15/-	+1/16	... ...
Edison-Swan	4/-	10	10	9/-	+3d.	4 9 0
do. 5% Deb. Stock	5	5	84	—	5 19 1	
Electric Construction	1	10	10	32/6	—½	6 3 0
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	5	19/3	—6d.	5 4 0
do. do. Pref.	1	6	6	21/-	—	5 14 3
Gen. Elec. Pref.	1	6½	6½	23/6 xd	—6d.	5 10 8
do. Ord.	1	5	7½	27/6	—1/-	5 9 1
Henley	1	15	16	3½	—	4 11 5
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	1 1/16	—1/16	*4 14 1
Johnson & Phillips	1	10	10	54/6	—	3 13 7
Met-Vickers, Ord.	1	8	8	27/6	—	5 16 5
do. Pref.	2	8	8	2⅝	—	6 14 9
Siemens Ord.	1	—	7½	32/-	—1/9	4 13 9
Telegraph Construction	12	20	20	27	+½	4 9 0

*Dividends paid free of Income Tax.

Electric Vehicles in France.

Some Particulars of the Renault Sight-seeing Cars.

DURING the past few years, as a result of the activities of the Société pour le Developpement des Véhicules Electriques and as an outcome of the annual trials which are being held, there has been a marked increase both in the construction and use of industrial electric vehicles in France. A firm which has hitherto been chiefly associated with petrol vehicles, but which is, in conjunction with the Société Alsacienne de Constructions Mécaniques, of Belfort, which is responsible for the electrical equipment now turning out electric trucks, 'buses, and sight-seeing vehicles is Renault Frères, of Billancourt, Paris. A number of the last-named cars have been employed during the past few months in conveying visitors round the Decorative Arts Exhibition in the French capital in the same way as the Railodok cars were used at Wembley.

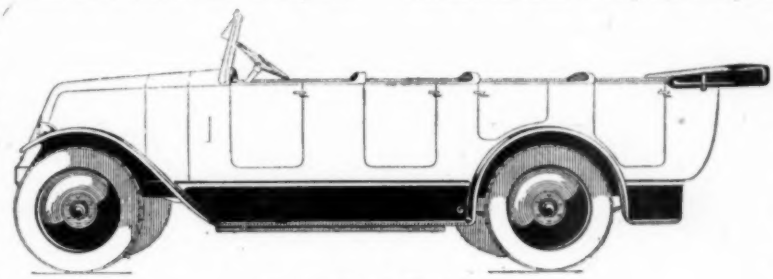


Fig. 1.—Renault Electric Car.

The vehicles are designed to carry eleven passengers, in addition to the driver, the body, which has doors only on one side, comprising four rows of seats. The chassis frame is rectangular in shape and perfectly straight both in elevation and plan, and is supported on semi-elliptical springs at both the front and rear. The electric motor, which is located just forward of the centre of the chassis below the driver's seat, is of the four-pole self-exciting type, with auxiliary commutating poles. It normally develops 5 h.p. at speeds ranging between 750 and 3,350 r.p.m., and is connected with the rear axle through a flexible coupling, enclosed propeller shaft, bevel and reduction spur gearing. The motive power is supplied by a battery of 40 lead accumulator cells arranged in two boxes containing 20 cells each and carried along the sides of the vehicle. The capacity is 210-230 amp.-hours at the 5-hour discharge rate, enabling the vehicle to cover a distance of about 56 miles on one charge. The battery boxes are secured in such a way that they can be detached and carried away on a special trolley for replacement purposes, or the cells can be charged *in situ*.

The electric control gear is readily accessible, being located under a standard Renault bonnet, and comprises an automatic cut-out which breaks the main circuit in case of overload; a lever giving neutral, forward, and reverse speed positions; a set of starting resistances; a field rheostat acting on the shunt winding, and enabling the speed of the vehicle to be varied between $3\frac{3}{4}$ and $18\frac{3}{4}$ m.p.h.; a battery-charging connection, and a lamp which warns the driver when the load on the battery exceeds a predetermined value. The vehicle is driven exactly as is a petrol car, the driver having at his command a starting pedal, a pedal accelerator, and foot- and hand-operated brakes. The foot brake acts on all four road wheels, whereas the hand lever acts only on the rear wheels. Interlocks are provided so that as the hand brake is applied, the battery-motor circuit is broken.

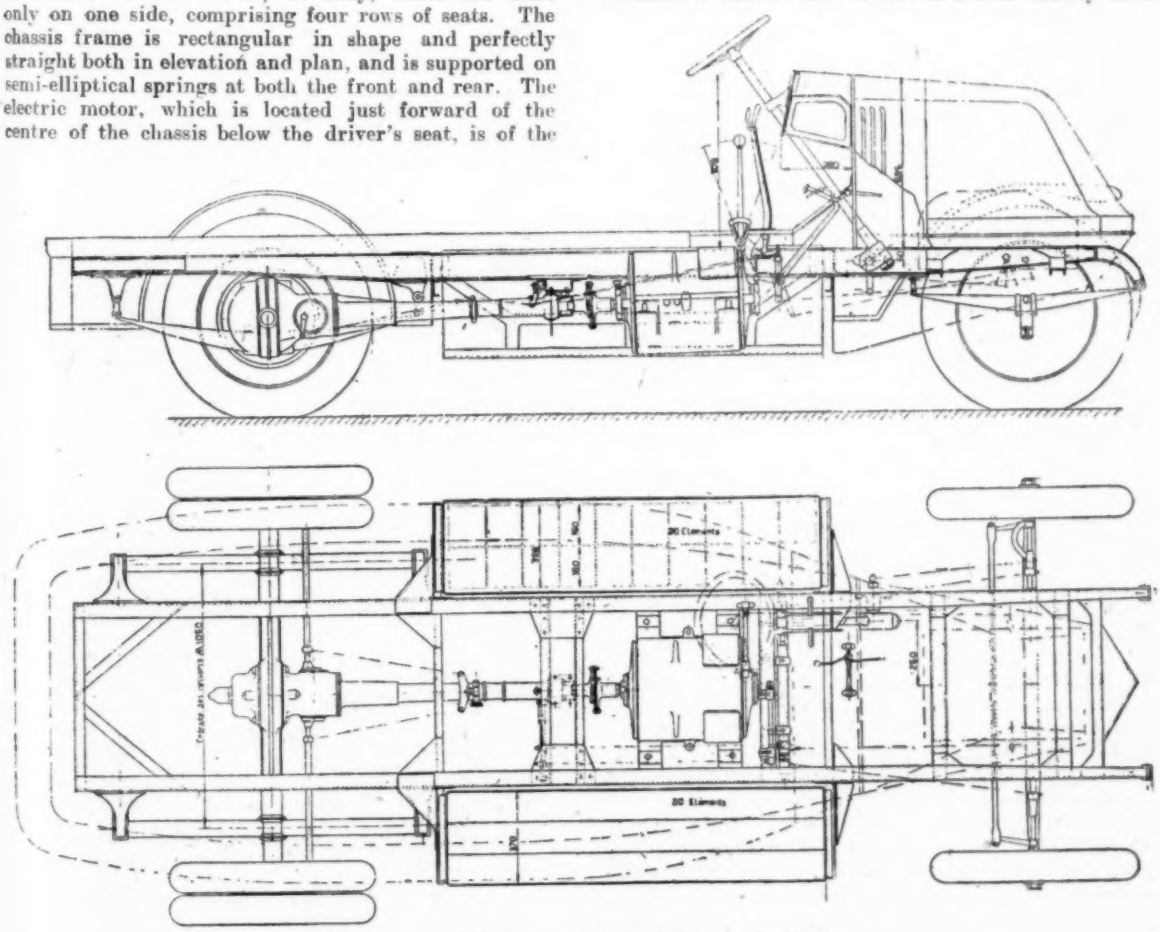
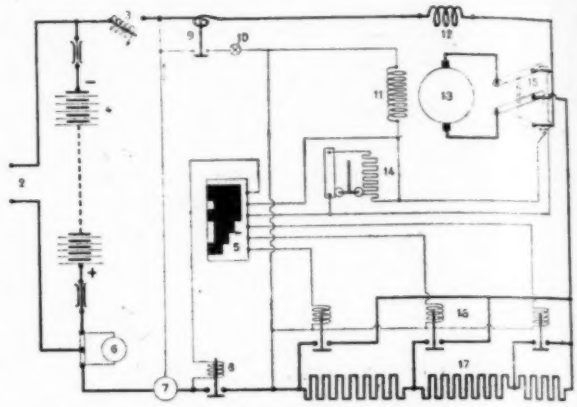


Fig. 2.—Elevation and Plan of Chassis of the Battery-propelled Charabanc.

The road wheels are of the disk type, shod with 820 by 120 mm. pneumatic tires, twins being fitted at the rear. The weight of the chassis is given as two tons, and that of the battery as between 16 and 18 cwt. Including the body, the vehicle is designed to carry a total load of about a ton. It may be added that the steering gear is mounted on the left side of the vehicle, and that the wheelbase is 10 ft. 6 in., with a track width of 4 ft. 9 in.

In view of the improvements that have been made in the manufacture and operation of storage batteries in recent years, and the experience that has been gained with public service vehicles at Wembley and at the Paris Exhibition, it is somewhat surprising that so few electric battery vehicles are employed for passenger transport. The fact that some of the pre-war experiments in this direction had unfortunate results should not prove a bar to further trials; the difficulties met with in the early days of the petrol-driven motor-car were triumphantly overcome, and the success of the commercial battery vehicle suggests that a good case might be made out for the passenger car, which for convenience, reliability, and ease of control is without a rival.



(2) Charging plug connection.
(3) Main switch.
(4) Battery.
(5) Coupling unit.
(7) Amp. and voltmeter.
(8) Main contact maker.
(9) Main relay.
(10) Indicating lamp.
(11) Shunt excitation.
(12) Series excitation.
(13) Motor.
(14) Speed-increasing rheostat.
(15) Reversing switch.
(16) Starting contact.
(17) Starting resistance.

Fig. 3.—Diagram of Connections.

The Shipping and Engineering Exhibition.

A Review of the Principal Exhibits of Electrical Interest.

(*Concluded from page* 931.)

Echo Depth Sounders.

An "earth inductor" compass was an interesting item on the stand of Henry Hughes & Son, Ltd., who also exhibited sonic echo depth-sounding apparatus, which can now be used by the merchant service under British Admiralty licence. The system (Mr. F. E. Smith, F.R.S.) depends on the indirect measurement of the time interval between the production of a sound wave under water and its reflection from the sea bed. The source of sound is a steel diaphragm fixed to the hull of the ship that is set in vibration by a spring hammer, which is withdrawn from the diaphragm by a solenoid, the circuit of the latter being broken automatically every half second. The note emitted has a frequency of 1,250 per second, and when immersed in water the diaphragm is heavily damped, so that the energy communicated to it by the hammer is quickly transferred to the water. The receiving hydrophone is a simple microphone enclosed in rubber and immersed in the water; it is comparatively aperiodic, and in the vessel a ½-h.p. electric motor, running at 1,800 r.p.m. (fig. 12) drives two switches through 10 to 1 reduction gear. Constancy of speed within 1 per cent. is obtained in spite of large variations in the supply voltage by a special centrifugal friction governor. One of the switches, which consists of a pair of brushes in contact with a rotating disk provided with an insulated segment breaks the 100-volt d.c. supply to the transmitter every third of a second for a period of about 0.0025 second. The other switch, running on the same shaft as this disk, short circuits the telephones in the receiving circuit, except as determined by the position (relative to the corresponding pair of brushes) of a second insulating segment. When, therefore, the apparatus is running no sound will be heard in the telephones unless the insulating segment in the telephone switch happens to open the telephone circuit at the instant when the transmitter is actuated, or at the instant when the echo returns from the bottom of the sea. By a simple mechanism the position of the brushes in the telephone circuit can be displaced by hand relative to the corresponding pair of brushes in the impulse circuit, so that an interval of time, proportional to the angular displacement of the brushes, intervenes between the emission of an impulse by the transmitter, and the opening of the telephone circuit. If a sound is heard in the telephone, the angular displacement of the brushes gives a measure, in terms of the known speed of rotation of the switch, of the time taken by the sound to travel from the transmitter to the receiver—a distance which is approximately double the depth of water, depth being read directly on a dial.

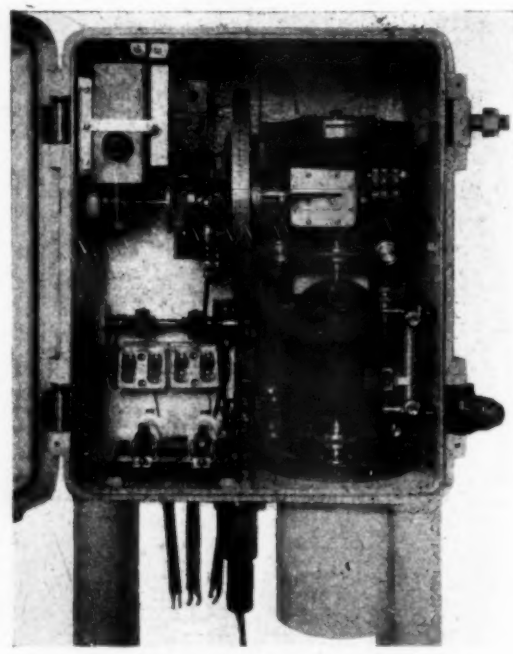


Fig. 12.—Depth Sounder Recording Mechanism.

Another depth sounder (Herr Behm, Germany) was shown by Kelvin, Bottomley & Bird, Ltd. The outfit comprises a time-interval recorder capable of measuring to a 1,000th part of a second; a small cartridge is discharged into the water, which detonates a few feet below the surface, setting up a sound-wave that jogs a "starting" microphone sufficiently to release the recorder.

The sound-wave eventually reaches a second microphone, after reflection at the sea bottom. The effect on the echo-receiving microphone is to stop the recorder, the time-interval being so short that the pointer appears to spring from the zero position on the scale to that indicating the true depth instantaneously. As a rule, the starting and the echo-receiving-microphones are on opposite sides of the ship, but when the ship's hull does not form a sufficient screen to enable the receiving microphone to be protected from the direct action of the detonating cartridge, the recorder is provided with a relay which interrupts the circuit long enough to allow the sound-wave which would have reached it by the shorter path to die away. The receivers are fixed internally hard up against the ship's plating, but without the necessity of drilling the hull. The cartridge is discharged into the sea electrically from the deck rail. Such instruments as electric engine-room telegraphs; loud-speaking telephones; helm, look-out, and navigation lights indicators were displayed by Siemens Bros. and Co., Ltd., and luminous signalling systems by the Sunderland Forge & Engineering Co., Ltd.

Engine Room Auxiliaries.

As representing engine-room and boiler accessories the collection of electrical CO_2 and CO recorders, draught and pressure gauges, thermometers and automatic temperature regulators, &c., exhibited by the Cambridge Instrument Co., Ltd., may be instanced. Water, steam, gas meters and recorders were seen on the stand of Geo. Kent Ltd., and the Electroflo Meters Co., Ltd. A double suspension furnace arch spanning two Bennis chain-grate stokers was shown by Liptak Furnace Arches, Ltd., as well as an interlocking air-cooled pulverised-fuel combustion chamber wall, while Edward Bennis and Co., Ltd., exhibited a graded forced-draught cellular chain-grate stoker complete; unlike usual practice, the electric fan furnishes air at comparatively high pressure to a Veni contractor, in which is induced a larger amount of air at a lower pressure. Steam air ejectors and condensate pumps were on the stand of John Musgrave and Sons, Ltd.; coal meters and water recorders were exhibited by the Lea Recorder Co., Ltd., economisers and accessories by E. Green & Son, Ltd., and boiler-house plant by Babcock & Wilcox, Ltd.

Boiler appliances featured by James Gordon & Co., Ltd., included an electrical water-level indicator and alarm which does not need the installation of apparatus inside the boiler drum, being operated by a thermostat such as is used with a Copes feed-water regulator.

Quantameters, Ltd., showed a form of water-level indicator that was brought out by the Aster Engineering Co. about a year ago. The device has no internal friction, depending on the choking effect of an alternating-current coil on a copper float that rests on a mercury bath which is balanced against the head of the liquid, the level of which is to be indicated. The indication is given at any distance by a voltmeter calibrated in feet, and it will be realised that the instrument measures quantity and not merely height, whilst its action being dependent on hydrostatic pressure, changes in specific gravity caused by variations in temperature do not influence its readings. The principle of this interesting gauge is applicable in a variety of ways.

Electric Trucks and Batteries.

Battery-driven trucks are, of course, much used in docks and warehouses, and they were represented on six stands, namely, those of G. D. Peters & Co., Ltd., R. E. Seal, Ransomes, Sims & Jefferies, Ltd., H. C. Slingsby, British Electric Vehicles, Ltd., and Joseph Booth and Bros., Ltd. Three stands were devoted to electric accumulators of the Chloride, Edison, and "Nife" makes.

Miscellaneous Exhibits.

Under this heading something like two dozen stands could be included; for instance, the Artofex Engineering Works, Ltd., included in its exhibits electric dough-mixing machines and cake mixers, and baking ovens of the sectional type. The Hotpoint Electric Appliance Co., Ltd., also had a range of electric heating and cooking devices, and vacuum cleaners were demonstrated by Electrolux, Ltd.

C. A. Vandervell & Co., Ltd., showed cabin lighting, engine starting, and ignition apparatus for small cabin cruisers and fast craft, starters for engines up to 250 h.p. being exhibited with suitable batteries, together with an automatic lifeboat safety lighting system, projectors, and electrical accessory fittings. Magnetos and engine starters were also shown by Simms Motor Units (1920), Ltd. W. G. Walker & Co. showed fan-brake dynamometers for testing motors, ventilating fans, and coil windings. Electric clocks and wind vanes, &c., were on the Magneta Time Co.'s stand, and photo-printing apparatus was shown by J. Holden & Co., Ltd., and also the Precision Photo Printing Plant Co. M. W. Woods exhibited fans, motors, rotary converters, and rectifiers, and Isenthal & Co., Ltd., control gear. The London Electric Wire Co. & Smiths, Ltd., needs no introduction; "Hollerith" electrical tabulating and sorting machines are products of the British Tabulating Machine Co. The display of the West Insulating Co. is indicated by its name, and electric furnaces were on view on the stands of Rustless Surf-Alloy, Ltd. (whose process consists of rustproofing iron and steel by alloying the surface with zinc), and of Automatic & Electric Furnaces, Ltd. (Wild-Barfield).

An All-Electric House.

Detailed Particulars of a 10-Room Glasgow Dwelling.

By Prof. S. PARKER SMITH, D.Sc., M.I.E.E.

(*Abstract of Paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

(*Concluded from page 952.*)

Hot Water.—It is possible to use small tanks or geysers in different parts of the house and so avoid all pipe losses, but an adverse critic might regard such a method as a makeshift. The arrangement in the present case is really due to Mr. R. B. Mitchell, who emphasised the desirability of developing new forms of night load. No better occasion offers itself for this purpose than heat storage in water. It was therefore decided to take energy for heating water between 11 p.m. and 7 a.m. Since the consumer's share of the capital charges is included in the two-part tariff, running charges will form practically the entire cost. The average running charges at Dalmarnock station are of the order of 0.25d. per kWh and the charge of 0.375d. per kWh proposed by Mr. Mitchell for domestic hot-water storage during night hours should therefore become popular. In order to make the experiment successful, however, it was necessary to obtain a well-lagged tank, which proved to be a difficult task. The author co-operated with Mr. Duncan Low, of Messrs. Arch. Low and Sons, of Glasgow, and tests were made with different forms of lagging until it was found that with a suitable application of cork the fall in temperature of the water was less than 1 deg. F. per hour. Further, it was found that by proper design the amount of mixing of the incoming cold water with the hot water in the tank could be made negligible. The tank, fed from the cistern, has a cubical capacity of 87 gallons, and supplies the bath and hand-basin in the bathroom, the maid's room, pantry, cloakroom, and three points in the kitchen. Near the bottom of the tank there are immersion heaters rated for 4 kW, 2 kW, and 1 kW. Near the top of the tank there is an emergency immersion heater rated at 2 kW, which auxiliary heater has proved to be very serviceable when the demand for hot water has been exceptional and the temperature has fallen too low for domestic purposes. For instance, it will heat up sufficient water for a 35- to 40-gallon warm bath in 30 to 60 minutes, according to the water temperature when switching on.

The tank thermometer is calibrated "high," "medium,"

and "low," to indicate in which position the switch has to be placed in the evening; in winter it is mostly necessary to place the switch at night in the "medium" position; in summer it is occasionally possible to switch on to "low." As a rule the tank is switched on about 10.30 p.m. and off at 7.30 a.m.—which partly accounts for the "hot-water" load curve being higher than the night load curve in fig. 4. Under the above conditions, the temperature of the water on switching off is usually in the neighbourhood of 140 deg. F., seldom as low as 120 deg. F., or higher than 160 deg. F. In addition to the house service throughout the day, there is sufficient water for two hot baths per day. The tank is placed in the bathroom, so that any heat loss is useful in warming this room; as a result it is seldom necessary to close the window or use a fire. To heat the water to, say, 180 deg. F., and install a smaller tank would be feasible and cheapen the first cost, but the losses from the tank and the pipes are much less at the lower temperature. Experience shows that it is more economical to supply water to the kitchen at the lower than at the higher temperature. Moreover, the possibility of working at the higher temperature in case of need gives the tank a good overload capacity.

Since the tank was installed no trouble whatsoever has been experienced and there has at all times been an ample supply of hot water—equal to some 12 to 15 gallons per person per day. Without asserting that the above method is the cheapest for obtaining hot water, Table 3 will show that the cost is reasonable, and by means of a thermostat it is simple to arrange automatic heat control for such a tank. The Clyde Valley Power Co. is prepared to sell energy at ½d. per kWh for domestic water-heating during night hours; it is possible that this charge may be reduced to ¼d. per unit. The Corporation of Greenock is offering energy for the same service at ½d. per kWh to all classes of domestic consumers. Supply authorities might also consider the desirability of hiring out storage tanks to consumers.

Ventilation.—Fresh air is drawn into the rooms through air bricks behind the fires in the recesses, and the amount of air can be regulated in a simple manner. The outlet for the vitiated air is a wooden grid let into the frieze and communicating with the flue in the external chimney breast. This arrangement has proved to be satisfactory, and the rooms do not get stuffy when the windows are closed. To supply rooms with filtered air would entail the use of a fan, filter, and ducts and the air could, if necessary, be slightly warmed by passing it through a convector before it leaves the outlet channel. Provision has been made for the possibility of forced ventilation, but the full details have not yet been worked out, as the need has not arisen.

Heating.—The author discarded the method of living in heated air as being inferior to radiant heat for the home. The human body appreciates heat rays, whether from the sun or from a glowing fire. Moreover, radiant heat is more pleasant in a cool than in a warm atmosphere. The electric fire renders it possible to obtain radiant heat in rooms with cool air, while owing to the portability of such fires the heat can be directed just where it is needed. Naturally, after a time the air becomes heated by the warmed objects in the room, &c., but the room can be kept cool by adequate ventilation. Experience shows that with ample radiant heat an air temperature of from 50 to 55 deg. F. is very comfortable, whereas with warmed air from 62 to 65 deg. F. is desirable.

To obtain the best results from electric fires, care must be used to have the heat where it is needed. In cold weather it is much better to have two, or even three, small fires suitably distributed in a room than one large fire. No difficulty or inconvenience of any kind has been experienced. The coal fire is not missed, while the ease with which the heat can be distributed and controlled is an advantage that would not be readily sacrificed when once enjoyed. The radiator load in the home, though large, reaches its maximum in the evening, and thus occurs after the afternoon peaks during the winter; consequently the domestic heating load is not troublesome to the power station.

Running Costs.—There are many features in an all-electric house, the value of which it is hard to appraise. Tables 1, 2 and 3 set forth the consumption and cost for the 10-roomed house for one complete year. The small discrepancies between Tables 1 and 3 are to be accounted for by meter inaccuracies. The analysis in Table 3 is based on a total day consumption cost of £33 19s. 2d. divided in proportion to the day meter readings in Table 2. The curves in fig. 4 represent the weekly consumptions of these items.

Conclusions.—A true and fair comparison can scarcely be made unless corresponding costs are available for similar services obtained from coal, gas, and electricity in some combination or other. Unfortunately, not many householders keep sufficient data to check their annual expenditure. In the author's case (total cost of 16,584 kWh used in one year was £43 8s.) the all-electric house in Glasgow cost practically the same as a somewhat smaller house in Wimbledon in which coal, gas, and electricity together cost £42 and £45 in two successive years. Here, however, much less hot water was obtained. In a slightly larger house in Helensburgh, using coal and gas, the cost was somewhat higher, varying from £58 to £44. Roughly speaking, the author would say that with energy at about one penny per kWh and a low tariff for water heating there would seem to be very little difference between the cost of an all-electric house and the same house using coal, gas and electricity. Consequently, on the score of running cost, even when the manifold advantages of electricity are entirely ignored, the objection to the all-electric house herein described cannot be sustained.

TABLE 1.

All-electric House (10 Rooms).

Energy cost for 52 weeks (4 quarters); six persons in house, excluding guests.

	£ s. d.
Main 2-rate meter: Fixed charge	12 10 0
Day load—10,299 kWh, at 0.5d.	21 9 2
Night load—6,043 kWh, at 0.375d.	9 8 10
Total cost for year	43 8 0
Average cost per week	16 8
Average cost per day	2 4½
Average cost per day per person	4½
Average cost per kWh—*day consumption* ...	0.791d.
Average cost per kWh—*total consumption* ...	0.637d.

TABLE 2.

Analysis of Consumption in kWh.

Separate meters.	Total kWh.	Weekly kWh.	Average Daily kWh.	Per day per person kWh.
Heating ...	5,954	114	16	2.74
Hot water ...	1,242 (day) 6,043 (night)	140	20	3.33
Cooking ...	2,777	53	7.5	1.27
Lighting ...	568	11	1.5	0.26
Total ...	16,584	318	45	7.60

TABLE 3.

Analysis of Cost.

Separate meters.	Total. £ s. d.	Weekly. s. d.	Average Daily. s. d.	Per day per person. d.
Heating ...	19 3 7½	7 4½	1 0½	2
Hot water	4 0 0 (day) 9 8 10 (night)	5 2	9	2½
Cooking	8 18 11½	3 5	6	1
Lighting	1 16 7	8½	1	¼
Total ...	£43 8 0	16 8	2 4½	4½

Regarding load factor, the hot-water and cooking loads are practically constant throughout the year and together form some 60 per cent. of the total energy consumption. Moreover, a part of the constant load, representing 36 per cent. of the total load, is taken at night-time. It is also interesting to see how unimportant lighting becomes, both as a load and as a source of revenue, when all services are worked electrically. Thus the all-electric house in question has an aggregate consumption of about 30 times the lighting consumption, practically without increase of station plant. An example of the daily load curve is shown in fig. 5 and represents the demand on a day when room-heating was practically restricted to the evening hours.

As regards reliability, the service has not once failed. Upkeep should not be a serious item when cookers and fires can be hired and are kept in order by the supply undertaking. Minor faults causing varying degrees of annoyance occur in electrical appliances, owing to faulty design or inspection in manufacture. Probably the weakest part of the installation is the flexible cord between the plug and the appliance.

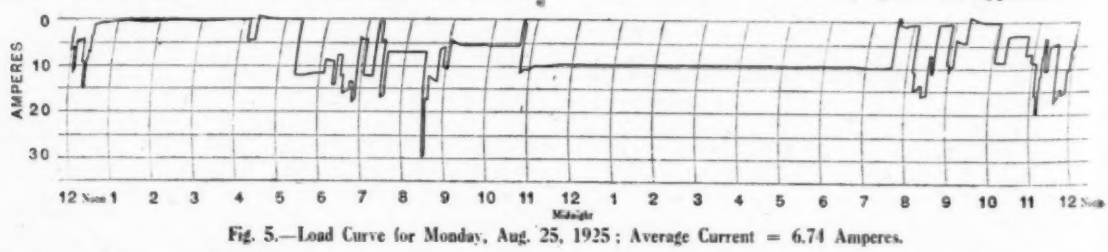


Fig. 5.—Load Curve for Monday, Aug. 25, 1925; Average Current = 6.74 Amperes.

Dalmarnock generating station uses about 1.8 lb. of coal per kWh generated. Assuming that a kWh delivered at the house needs 2.24 lb. of coal, then 1,000 kWh require one ton. Consequently, between 16 and 17 tons of coal would be needed at Dalmarnock annually to supply the services of the above all-electric house. This amount of house coal—assuming that all services could be obtained from raw coal on the premises—would cost, say, £33, while the coal used at the station would cost less than half this amount. For the coal industry it is probably better to increase the demand for station coal rather

than for house coal, while the householder will readily forgo the handling.

The drop in cooking consumption seen in fig. 4 is mainly due to the use of lighter grids. It is hoped that the present experiments will lead to further improvements in this direction. Speed and indestructibility are the ideals to aim at in the design of boiling-plates. The merits of separate utensils with built-in elements also deserve closer study. The cost of installation seems now to be receiving the sympathetic attention of supply undertakings, and the absence of coal fires in a house like the one just described may make it possible to dispense with one domestic servant and thereby not only more than repay the total cost of the electrical energy, but also lighten the domestic labour problem. Equally, the improved health of the community, by eliminating smoke, is an inestimable benefit.

Appendix.—For comparison, the following figures for a flat (three rooms and kitchen) in the west end of Glasgow are added by Mr. B. Hague, M.Sc., A.M.I.E.E. They are based on the same two-part tariff as the author's, and refer to the past year's all-electric working. The flat is at the top of the building, so that the carrying up of coal and removal of ashes presented a real problem; satisfactory ventilation can be obtained from the now unused fireplaces, combined with the judicious use of opened windows; the fires are *not* placed in the fire recesses, but are set out in the room where most required.

TABLE 4.

All-electric Flat (4 Rooms).

Energy cost for year; total consumption, 4,656 kWh.

Cost of energy at ¼d. per kWh	2,328d.
Fixed charge of £5.2	1,248d.
	3,576d.

	£ s. d.
Total cost of energy	14 18 0
Average cost per week	5 9
Average cost per day	10
Average cost per day per person	3
Average cost of energy per kWh	0.768d.

The cost of hiring the cooker and two fires was £2.

The installation provided for a household of two persons (not counting guests and occasional labour), lighting, cooking of meals, hot water for domestic services and baths, heating of rooms (inclusive of occasional heating of bathroom and bedroom) and small auxiliary services. A single meter was provided, and daily readings verify the general conclusions given in the paper, *viz.* :—(1) Lighting is a small factor; (2) cooking is a fairly steady load; (3) heating is the cause of the greatest consumption and fluctuates greatly in response to seasonal variations of temperature. The energy cost is given in Table 4.

One figure, often quoted in statistics of this nature, requires comment, namely, the cost of energy per person per day. This figure, in itself, is a misleading criterion of the working of any scheme unless it is accompanied by a statement to show what services are rendered for the price. If the present household were increased to three, in none of the services would the consumption increase in proportion to the larger number of persons. Hence the cost per head per day would fall roughly to perhaps three-quarters of the preceding figure for the same domestic facilities. Thus the cost per day is a truer criterion than the cost per day per person (which is borne out by comparison between Tables 1 and 4).

As a further comparison, it may be mentioned that a Glasgow bungalow with three persons using coal, gas, and electricity, cost £15 15s. per annum, ignoring the smaller items, such as firewood, matches, &c.

Electrical Imports of British Malaya.

BELOW are given the values during 1924 of the imports of electrical and allied material into the Straits Settlements and the Federated Malay States. No strict comparison can be made with previous years owing to an alteration in the classification. It may be stated, however, that whereas in 1923 the total value of the imports of electrical machinery was given as $1,830,000, the totals of the four last items in the following table amount to only $995,000.

	Straits Settlements.	Federated Malay States.
Wire and cable, insulated.—	$	$
Total	946,000	83,000
From United Kingdom	937,000	80,000
,, Japan	1,000	—
,, United States	6,000	3,000
Telegraph and telephone instruments and apparatus.—		
Total	160,000	124,000
From United Kingdom	142,000	124,000
,, United States	9,000	—
,, Sweden	1,000	—
Electric lamps and parts.—		
Total	144,000	12,000
From United Kingdom	62,000	4,000
,, Germany	21,000	—
,, Italy	15,000	—
,, Holland	19,000	8,000
Electric glow lamps.—	$	$
Total	13,000	600
From Holland	8,000	—
,, France	—	600
Electric arc lamps.—		
Total (mainly from U.K.) ...	6,000	—
Batteries and accumulators.—		
Total	95,000	9,000
From United Kingdom	41,000	4,000
,, Japan	9,000	—
,, United States	42,000	4,000
Electric lighting accessories and fittings.—		
Total	109,000	21,000
From United Kingdom	73,000	18,000
,, Germany	6,000	100
,, Holland	4,000	3,000
,, Japan	11,000	—
,, United States	11,000	50
Electrical goods and apparatus (not machinery) not elsewhere mentioned.—		
Total	510,000	48,000
From United Kingdom	397,000	45,000
,, Italy	32,000	1,000
,, Sweden	12,000	—
,, Japan	13,000	—
,, United States	32,000	2,000
Electric generators.—		
Total	79,000	23,000
From United Kingdom	63,000	23,000
,, France	4,000	—
,, United States	7,000	—
Motors.—		
Total	533,000	33,000
From United Kingdom	246,000	29,000
,, France	17,000	—
,, Germany	22,000	—
,, Holland	9,000	—
,, United States	234,000	4,000
Ignition magnetos.—		
Total	36,000	4,000
From United Kingdom	6,000	500
,, France	5,000	—
,, Germany	17,000	—
,, Italy	4,000	—
,, United States	3,000	3,000
Other electrical machinery.—		
Total	249,000	38,000
From United Kingdom	224,000	37,000
,, Belgium	3,000	—
,, France	4,000	1,000
,, Italy	3,000	—
,, Holland	4,000	—
,, United States	2,000	—

Indian Electrical Imports.

(From Our Indian Correspondent.)

THE total imports into India of electrical machinery, instruments and apparatus during the six months from April to September of 1925 amounted in value to Rs. 209 lakhs as against Rs. 188 lakhs in the corresponding period of last year. Out of this, machinery was responsible for Rs. 96 lakhs as against Rs. 98 lakhs in 1924, and instruments and apparatus were valued at Rs. 113 lakhs as against 89 lakhs. There would therefore appears to have been a slight decline in the case of machinery and a satisfactory increase in the case of instruments and apparatus. Quantitatively there does not appear to have been any decline in machinery imports as prices were rather lower during the period. The imports of the various classes of electrical machinery were as follows :—

	1924. April-Sept. Rs. lakhs.	1925. April-Sept. Rs. lakhs.
Control or switchgear	16½	18½
Generators, dynamos, &c.	17	16
Motors	20	17
Transformers	5½	6¾
Turbo-generating sets	2	3¾
Other machinery	37	34

Out of the Rs. 96 lakhs worth of machinery, the United Kingdom's share was Rs. 76 lakhs. This was a considerable decline from the corresponding period of 1924, when the imports from the United Kingdom amounted to Rs. 85 lakhs. Imports from Germany increased from Rs. 2 lakhs to Rs. 5¼ lakhs and those from the United States of America from 6 lakhs to 7¼ lakhs. The latter country is now making considerable effort to regain the position which she lost during the previous year. Imports from the United States during April to September, 1923, amounted to Rs. 18½ lakhs.

As regards the imports of electrical instruments and apparatus, as already mentioned, there was a satisfactory increase.

The imports of electric fans increased from 12 lakhs to 14 lakhs, wires and cables from 34 to 37½ lakhs, electric lamps from 8½ lakhs to 14 lakhs, accumulators from 4½ lakhs to 5½ lakhs, electric lighting accessories from 8 lakhs to 8½ lakhs, meters from 3 to 3½ lakhs, and batteries from 4 to 5 lakhs. On the other hand, there were slight decreases in switchboards, carbons and unenumerated goods.

In this trade, the United Kingdom increased her share during the period, to 73½ lakhs as against 60½ lakhs in April-September, 1924. Though this appears to be a satisfactory increase it has to be remembered that in the corresponding period of 1923 the imports amounted to 92 lakhs. Other countries also increased their shares, Germany from 11 to 12 lakhs, the Netherlands from 3½ to 5½ lakhs, Italy from 2½ to 3½ lakhs, and the United States from 9 to 12 lakhs.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

There are now on the market several types of apparatus which, it is claimed, enables any make of radio-telephone receiving apparatus to be operated from the domestic electricity supply mains, the set being switched on and off very much like a lamp or radiator. The idea is to provide a device that will enable the user to dispense with batteries and accumulators and, at the same time, minimise the generator hum which is frequently heard when operating off the town's supply mains.

The "Chargeless Supplier."

An outfit of the above-mentioned kind is marketed by MESSRS. ATTAIX, LTD.; for a.c. service it consists of a perforated-metal box on top of which is a tumbler switch and three pairs of leads: two of them are used to furnish the h.p. and l.p. currents to the receiver, whilst the third is plugged into a lampholder or wall plug; the special cover of the combined plug-adaptor protects the user against shock and short circuit. Two rectifying valves are locked in the box, so that access to them cannot be gained unnecessarily, but no rheostat is needed as the box also contains a special resistance lamp that automatically takes any excess load, and also any increase in the voltage of the mains

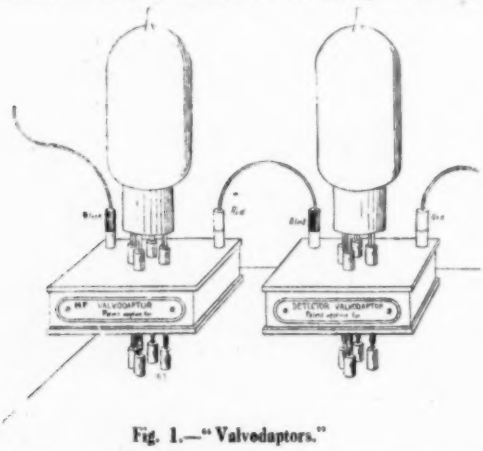


Fig. 1.—"Valvodaptors."

up to 30 per cent., so that the rectifier is operated simply by the above-mentioned tumbler switch, and suffices for from one to six valves. It should, however, be noted that only dull-emitter 0.60-A valves should be used. The h.p. current is delivered at from 70 to 90 volts and the l.p. is between 3.5 and 4 V. When operating off a.c. supply mains "valvodaptors," illustrated in fig. 1, are essential in most cases; they are made to fit the valve holders of any make of receiver set and in three patterns according to position, namely, h.f., detector, and l.f., their function being to connect all the valves in series. The d.c. "chargeless" outfit is similar, but of course no rectifiers or valvodaptors are necessary and a rheostat is used instead of the regulating lamp; the negatives of the h.p. and l.p. should not be coupled. The makers guarantee freedom from generator noises on both a.c. and d.c. circuits at all frequencies between 25 and 100 cycles per second.

"Clix" Twin Plug and Ringtags.

The latest additions to the varied range of accessories produced by MESSRS. AUTOVEYORS, LTD., are twin plugs which can be effectively employed for battery connections, multiphone applications, and wherever the possibility of a short circuit being made by the contact of two independent plugs necessitates dual connections. Ringtags are useful terminators for stranded wire, and particularly so for employment with "Clix." The difficulty experienced by some people in manipulating hollow radio conduit with ordinary pliers has precluded their full use of it for interconnecting components of receiving apparatus, but it should be noted that trouble of this nature can be overcome by the use of round-nosed pliers, which assist the conduit to bend into most shapes.

Another Pendant Loud-speaker.

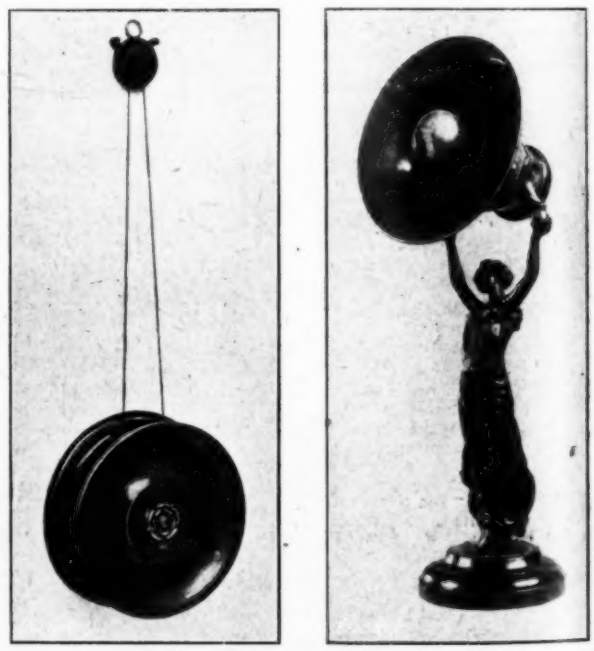
An improvement on the hanging loud-speaker recently illustrated in these columns is the "Mellovox Pendant" shown in

Fig. 2.—New "Mellovox" Pendant Loud-Speaker.

fig. 2, a product of the MARCONIPHONE CO., LTD. This accessory fulfils the functions, not only of a loud speaker, but also of an electric lampholder and shade, and is equipped with a plug which enables one to plug direct into the existing lampholder which is usually suspended from the ceiling. In this method of suspension trailing wires about the floor and tables are eliminated and the artistic shade adds to the decorative effect of the drawing-room.

New "Claritone" Loud-speakers.

Broadcasting having reached that stage at which receiving apparatus is commonplace in most homes, there has arisen a demand for modified forms of construction and styles of finish which will harmonise with the appointments of the rooms in



Figs. 3 and 4.—Plaque and Statuette "Claritone" Loud Speakers.

which receiving sets are commonly used, but the improvision of an attractive and unobtrusive loud speaker is not easy, for by virtue of the fundamental laws of acoustics it is essential that some of the dimensions of sound amplifiers must be fairly large. Enclosing the conventional model in a cabinet and concealing the presence of the horn by a fretted sound-aperture panel in the front is common practice; it, however, entails a larger and more costly cabinet than would otherwise be necessary. Accordingly, two new designs of speaker have been introduced by the Automatic Telephone

Manufacturing Co., Ltd., which differ considerably in external appearance from the two familiar "Claritone" models with the conventional "swan-neck" horn. In one of the new models, fig. 3, the horn has been eliminated and replaced by two bowls, between which there are amplifying passages which function in a similar fashion to an ordinary trumpet. This form of construction lends itself to a much more compact and flattened exterior, resembling an ornamental plaque, which can be hung from a picture rail or strong hook against any convenient wall. Suitably strengthened conductors serve as cords for this purpose and lead to terminals mounted on a moulded insulating medallion which also carries a suspension eyelet; by running the connecting leads in the groove of the picture rail, all trace of wires can be concealed. The statuette model, fig. 4, provides graceful supports for the receiver, sound passages being arranged within the central portion, which provides the length necessary for correct reproduction. In both these new "Claritone" models the original receiver mechanism is retained, together with the lever adjustment for varying the air gap between the diaphragm and magnet poles. The wholesale distributing firm is the Ashley Wireless Telephone Co.

Correspondence.

Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Salaries of Combustion Engineers.

Your "Shift Engineer" correspondent can rest assured that in the majority of cases there is no belittlement of his status, by raising that of the combustion engineer, for the simple reason that in a considerable number of instances the wireman-cum-switchboard attendant-cum-shift engineer procedure holds good. This being so, it is not surprising that we are confronted with the pertinent query: whence cometh that practical knowledge of boiler-house thermal efficiency in detail, so essential to fuel economy, to justify senior rank being given to the shift charge of the type referred to? The fact remains that the creation of the position of combustion engineer was due to the inefficiency of the majority of shift engineers in matters concerning the efficiency of heat liberation and transfer and not to their inability to devote the necessary time to the efficiency of steam production, as suggested.

The logical deduction is that the man whose training enables him to get an easy grasp of the fundamentals coupled with the study of the main essentials to economical power production should, to say the least, have a higher rating and remuneration than the man who, by virtue of his training and consummate lethargy, tends to become nothing more or less than a rule-of-thumb operator.

W. D. W.

December 10th, 1925.

Regarding "Shift Engineer's" letter on the above subject, I am afraid he has a great deal to learn. It makes one smile when he says that in his opinion every shift engineer worthy of the name is a combustion engineer. Far from it! as is shown by the wretched thermal efficiencies of the power stations of England for the last 12 years, averaging not more than 12 per cent.; boiler-house efficiency about 65 per cent. Combustion is a science, and it needs a specialist to deal with it, not a shift engineer who knows, in most cases, a lot about everything but is master of nothing. Who is "Shift Engineer," by the way, who goes beyond his superior officer who engages the combustion engineer, when he says a combustion engineer is only necessary because he himself has not time to attend to the boiler house? Yet he signs the coal sheet, when he acknowledges he hasn't time to devote himself to the boiler house.

The combustion engineer is not paid as much as the shift engineer for the very reason that England at present is behind the times. The boiler house is still to a large extent looked upon as a necessary evil which one must have but which it is best to ignore, and that is only because we have not yet looked upon combustion as a highly technical science. We are only just beginning to learn that a great saving can be made by burning our coal efficiently. An enormous saving can be and will be made in the production of steam in the future, provided that a specialist is obtained to control the burning of our coal, a specialist on each shift, who will have sole command in the boiler house and be responsible for it during his shift, as in America. I can see that in the future a shift engineer will be in control of the turbine room and control room and his responsibility will cease at the turbine stop valve; from there the combustion engineer will be in command, and the latter will be paid a higher salary for the very reason that it is in his hands to effect an enormous saving due to his being a specialist in efficient combustion. The position of combustion engineers is a fairly new one and so naturally we are placed under the shift engineer; it is because of this that the efficiency of a boiler house has not yet attained the high degree it ought to have done. When the chief engineers place more confidence in us and allow us to run the boiler house under our orders, the efficiency will go up.

A Combustion Engineer.

December 8th, 1925.

Rural Electricity Supply.

I think your readers will agree that, prior to Mr. F. W. Purse's intervention, Mr. S. C. Bartholomew and I were proceeding with our discussion—giving and taking hard blows with mutual good temper—and I understand we were followed by many readers with interest and enjoyment. In the process much useful information was divulged on both sides, and we are all now waiting for the figures which Mr. Bartholomew really ought to produce to justify the refusal to put the Northwich-Middlewich and Winsford local line underground, which caused the Middlewich monstrosity. I submit that, in default of clear proof that no cheaper method was possible, I am entitled to a verdict to the effect that the Post Office proceeds by rule rather than by reason, whereas there is an urgent necessity in the public interest that reason must come before rules. As a subsidy is under official consideration for rural supplies, the public has not only an ultimate interest in seeing that a State monopoly does not hinder other equally important services, but also, as taxpayers, in seeing that the habit of making a fetish of rules does not cause unnecessary expense.

Those undertaking rural distribution will frequently meet with Post Office lines in the areas between towns and in every village street. An attitude like that taken up by the Post Office in the discussions set out in the report of the Electricity Commissioners is a confirmation of the correctness of the remarks I have made as to the self-centred attitude hitherto characteristic of the Post Office. I believe the Government which controls the Post Office, and which also wants rural electricity supply, will help us to secure the active co-operation of the Post Office in giving our service to the rural dweller, even if it involves the sacrilege of recasting some of its rules. We must not omit to let the Government know the real position.

With Post Office reform, coupled with some slight modifications in the regulations and permission to use earth as a return on conditions similar to those for tramways and railways—surely a very modest request—overhead lines can be constructed at sufficiently low cost to avoid any rural development subsidy, except in special cases. We also have to get rid of the delay of from three to six months in obtaining permission to use overhead instead of underground mains, even in areas where nothing but overhead mains would be encouraged by the Commissioners. We shall then be ready to deal with rural areas on a practical basis.

I gather from Mr Purse's questions in his last letter, which answer themselves, that he had not intended to advocate the compulsory application of the 1924 edition of the I.E.E. Rules; that he does not approve of the policy of subsidy, and that he intended his reference to Ontario giving a 50 per cent. subsidy to be a warning and not an example. He now offers to assist me in forwarding rural development, if I will refrain from abuse. I can gladly accept his offer because I have never abused an opponent. I have exposed official inertia, but have stated that Post Office engineers are helpless in the face of the rules and the Post Office system; I have criticised rules, not rulers. Looking back over the correspondence, I find that my opponents have not been so careful to spare the man. I have been called a Don Quixote—that lunatic embodiment of the spirit of chivalry. I have been called the reciprocal of a big man, and worst abuse of all, have been classed by Mr. Purse with *astute* lawyers. This last insult could not be borne by an engineer, so I "lashed out." As Mr. Purse's complaint was based upon a misunderstanding of this apparently small, but really important, difference between man and matter, I am sure he will withdraw his original slighting remarks as I gladly withdraw my replies, which were intended to be caustic but not "sneering."

The ELECTRICAL REVIEW's decisive part in this movement deserves widespread recognition. The Editors also have been most generous in the allocation of valuable space.

W. Fennell.

Northwich, *December 10th*, 1925.

I have been particularly interested in the correspondence passing through your columns on this undoubtedly important subject.

There is no doubt that we in this country are seriously handicapped by regulations, and your issue of November 20th, containing Mr. R. Borlase Matthews's letter, gives us something to think about.

Apart, however, from the technical side involving factors of "ignorance," I feel that the question of wayleaves is not stressed sufficiently. Figures have appeared in your columns and scant references have been made by the writers therein to this subject, but unfortunately we are not getting at the right people by writing to the technical Press.

I have spent the past sixteen months doing that thankless work—the negotiation of wayleaves—in the Midlands and I can only describe it as heartbreaking. It is undoubtedly a task for those fortunate people blessed with an unlimited amount of tact, and perhaps I have only recently found it. At any rate I have spent about nine months negotiating wayleaves for about ten miles of single-pole 11,000-volt line where some twenty-four landowners are involved. Surely there is one answer to Mr. Matthews's question as to how to reduce the cost per mile of overhead line!

Some may say that their answer would be to dismiss the writer as incompetent! Sometimes I feel so discouraged that I would make the same answer. But my point is this: that in spite of the 1919 Act and Section 22, we are still up against the farmer, but more still, that person I dread—the estate

agent. I have spent hours arguing about "poles in hedges" and "poles in fields" and "eyesores," and so on *ad inf.*, but one might as well talk to a deaf mute (with all due respect).

I will admit that our great difficulty is the matter of rental. Heavy rentals have in the past been agreed, because the supply authority had no option, I presume, and one always hears that so-and-so is getting as much as £5 a pole from the Post Office, so why shouldn't he? To talk about a "cheap and abundant" supply of electricity usually involves some retort about dividends and no amount of persuasion will impress upon the landowner that in the long run he will have to lose on the bargain by insisting on a high rental.

I would suggest that the only way of easing this point is to standardise rentals by Act of Parliament (for different kinds of land, of course). It would make my job easier, anyway, and apart from that it would reduce the ultimate cost of the proposed line. Section 22 is very useful, but the delay caused by having to use it loses revenue from a line which might have been earning money months ago, but for one or two owners sticking out for a higher rental.

I should be delighted to hear of some of the experiences and suggestions of any other "wayleave makers" who read your columns, because I feel that as yet I must have lots to learn!

There are only two remedies in my mind at present. The first one (which I will confess is not original) is to serve every farmer in the country with a copy of Section 22! The second is to advertise the trouble in the daily Press. (Incidentally, a protest of mine on these lines was returned "with the editor's regrets.") I notice that admirable body, the E.D.A., is giving us a hint about electricity in the home most days and wonder if this question could be taken up by it?

W. W. Clarke, B.Sc. (Eng.).

Ilkeston, *December 8th*, 1925.

Chemical and Combustion Engineering.

I sincerely hope that the scheme for making Finsbury Technical College a centre for teaching chemical engineering will succeed, and I suggest that the systematic teaching of *combustion engineering* be located there also.

Chemical and combustion engineering are very much akin, because combustion engineers and fuel technologists must necessarily have considerable knowledge of organic and inorganic chemistry. Objection may be raised that the Finsbury building is unsuitable for boiler testing, &c., but no doubt arrangements could be made at a near-by power station to run occasional boiler trials.

If the above suggestion were to be carried out, Finsbury College might also become the headquarters of the Institute of Chemical Engineers, and also of a new Society of Fuel Technologists or Combustion Engineers, which is badly wanted, because of the greater advances now being made.

It is becoming the fashion to locate scientific and engineering societies in colleges, *e.g.*, the present address of the American Electro-Chemical Society is at the Columbia University, New York City, and at one time it was at Lehigh University.

Another suggestion I make is that a scholarship for combustion engineering be founded to perpetuate the name of Bettington, a principal pioneer of pulverised fuel firing, who lost his life as an aviator in the war.

E. Kilburn Scott, A.M.Inst.C.E., M.I.E.E.

London, *December 11th*, 1925.

The Metering of Three-Phase Power.

Mr. Jaques will no doubt agree that if the sum of the three voltages between each phase and star point is zero, a two-element 3-phase, 4-wire meter will register a 4-wire load, however unbalanced, quite as accurately as a two-element meter will register a 3-phase, 3-wire load, however unbalanced it may be provided always that the sum of the three line currents is zero.

The above condition could not have been complied with in the steel works referred to, and if the supply was given along a length of low-pressure cable, having a fair voltage drop, the unbalanced nature of the load would prevent the condition $e1 + e2 + e3 = 0$ being complied with. What I wish to emphasise is that the error was due to the delivered voltage and not due to the nature of the load. I give some figures below for a steelworks load consisting of induction motors and single-phase welders connected across phases. The supply is given direct from a delta-star step-down transformer installed in the works, and is metered on the l.p. side by means of a two-element 3-phase, 4-wire meter in series with three single-phase meters. The voltage $e1 + e2 + e3 = 0$, provided the sum of the voltages between each of the three pairs of h.p. lines is zero (which must be so as the supply is three-wire) and provided that the power transformer has the same ratio on each of the three limbs at all the conditions of load metered. My experience leads me to consider the latter to be the case within reasonably small limits.

The following are the figures, which show the two-element meter to be accurate:—

Three-phase meter	100%	of units consumed	
Single-phase meter on phase A ...	32.4%	,,	,,
,, ,, ,, B ...	14.3%	,,	,,
,, ,, ,, C ...	53.0%	,,	,,
Total of single-phase meters ...	99.7%	,,	,,

In the third paragraph of his letter, Mr. Jaques misquotes me when he says I agree that three separate metering elements are desirable for the correct metering of a three-phase, four-wire supply. I said three separate meters, and I do not agree that it matters not whether they are in the same case or not. Although I have in the past made tests which show that there is more interaction in a three-element than in a two-element meter of the same make (and I have yet to discover the meter without interaction) I have not the figures at hand, but I shall have the results of some tests available shortly and will communicate them.

The statement of Mr. Jaques that I was anxious to see supported by facts and figures if possible was his statement that he had often seen inaccurate metering systems operating against the consumer. What proportion of power consumers does he estimate are being overcharged?

A Meter Superintendent.

December 14th, 1925.

The Salaries of Assistant Engineers.

It would appear to me that some of your advertisers who invite applications for appointments as "Assistant Engineers" feel very optimistic towards filling their vacancies satisfactorily.

It seems hardly credible that an efficient and responsible man possessing all the qualifications stipulated (namely, good technical education, workshop training, sound central-station experience, together with knowledge of internal-combustion engines and, perhaps, steam engines and boiler-house experience) could be found for the wages offered, unless the applicant had a private income (which, of course, is not usual amongst young electrical engineers).

However small a power station is, provided it is worthy of that name, the engineer, who is responsible for all matters affecting the efficient running and maintenance of the plant, is worth more than a bare living wage!

I feel sure that some of your readers will agree with me that I am justified in stating that the present-day assistant engineer, that is, the man who does the hard work and gets told off whether he is at fault or not, is greatly underrated in sterling worth.

F. C. Zula-Crosse, B.Sc.

Hollinwood, *December 10th*, 1925.

Cutting Girders Under Water.

We should be much obliged if any of your readers could give us information regarding the sub-aqueous cutting of girders, &c., by the electric arc, and if possible tell us the names of any manufacturers of the necessary plant.

Arc.

December 9th, 1925.

The All-Electric House.

I have been much interested in reading the first instalment, which you have published, of Dr. Parker Smith's interesting paper, and your comments thereon.

In view of your regret at the curtailment of the debate, I trust you will be able to spare space in your columns for a discussion by correspondence.

Dr. Parker Smith is to be congratulated on his pluck in building such a house, in face of discouragement, which I daresay was not confined to one sex. I would wager that he had to overcome intuition as well as reason.

The results must be considered very satisfactory. If any man or woman doubts the advantages of the all-electric house, I would recommend him or her to undertake, personally, the cleaning, relaying, and lighting of, say, three open fires one morning; and not to neglect to sift and save all cinders above one-eighth of an inch in size. Afterwards he, or she, should take a damp duster and go carefully over the whole exterior surface of every article in the three rooms to remove the resultant soot and ash.

When labour and dirt are reckoned, the all-electric house wins easily.

Next to the all-electric, I would rank a combination of gas and electricity far above a combination of electricity and coal fires.

The heating of water has hitherto been regarded as the great stumbling block; but Dr. Parker Smith has got over this by his immersion heaters. It would be interesting to know whether his tanks and pipes are thoroughly lagged.

Dr. de Ferranti's point that refuse disposal must be provided for is important. In Glasgow they are now building the biggest combined destructor and electric generating plant yet undertaken, and everyone's refuse will be collected, transported (a long way) to this station, and there turned into electricity, for power and light, and clinker for clinker-bitumen road surfaces.

In places where refuse collection is not carried out, small incinerators for home and garden refuse and rubbish can be easily obtained for each house, or group of houses, and they convert the refuse into a valuable fertilising ash.

It is a reproach to successive Governments that electricity is still in a vicious circle. Until it is cheap it will not be generally used, and until it is generally used it will not be cheap. Glasgow has broken the circle for herself, and made possible Dr. Parker Smith's ideal home.

G. Watson.

London, *December 12th*, 1925.

The Contractor and Assisted Wiring.

The discussion excited by the almost sensational success of the first experiments in this direction has elicited various contributions from the wiring contractor's side. These range from a frank recognition of the facts (which does him credit) by Mr. L. G. Tate, through the political misgivings of Mr. R. E. Robson, to the engaging candour of Mr. Howard Smith, who "sees nothing in these assisted wiring schemes"—for the contractor.

It is perhaps only human nature that the contractor should be painfully struck by the "nothingness" of a development which renders it apparent that he is no essential link in the electrical chain. The hard fact is, however, that the producing and consuming sides of the industry care nothing for the weal or woe of the electrical contractor as such, and will certainly not see their long overdue *rapprochement* impeded by any consideration of providing him with an easy living, if he cannot make it to their advantage to do so. Thus if, to quote Mr. Howard Smith, the contractor does not fancy touting for orders for three-light installations and other small beer, he will be politely ignored while these contemptible little installations, *in their millions*, are put in by someone else. After all, where is the installation contractor in the great gas industry? It exists, in a very lively state of health, without him.

Then consider the wickedness of the supply authority which purchases material direct from the manufacturer, instead of allowing the honest factor to draw a percentage on the price for passing orders through his books. He does not even need to touch the material, which, owing to the quantity, the manufacturer will doubtless deliver direct to the supply authority. He is not giving extended credit; he is not here assuming any risk of bad debts. What then is the service he can render? The plain fact is that if any middleman *can* be dispensed with he *should* be dispensed with.

With regard to the Socialistic developments which Mr. Robson fears, if the contractor is an efficient, enterprising, and useful member of the industry he can doubtless show the supply authority that it will be a saving to entrust the work to him. If it still persists in doing the job itself at greater cost, it has the ratepayers to reckon with. Mr. Robson says: "It is admitted that private enterprise is responsible for the advancement of any industry, and that wherever the State has undertaken a commercial venture it has been unsuccessful." But Mr. Robson would surely not contend that all municipal commercial ventures have been unsuccessful? Mr. Edgar, whose enterprise he commends, is himself a municipal official. Public control of public utilities, although a form of Socialism, is not nowadays considered to need any defence.

It is quite certain that without assisted wiring in some form or other the penetration of electricity into the great mass of small homes will never take place. Will the wiring contractor clutch at the broom of Mrs. Partington, or endeavour to adjust himself to the inevitable?

A Manufacturer's Salesman.

December 11th, 1925.

Overhead Distribution.

As the engineer responsible to the B.D.S. Co., Ltd., for the distribution scheme in Brundall, I am interested in Mr. Glendenning's remarks. Having "had a look at the village," he is of course quite entitled to express his keen disapproval of the system adopted.

The financial point of view can always be ignored by those who have no financial interest in a scheme of the kind, but I am afraid that the financial question is of the most important consideration if rural distribution is to be encouraged, and to be of real service to the country.

Taking the Brundall proposition as an example, the company is actually supplying current to about 75 per cent. of the inhabited houses in the village, and as I trust (living in Brundall) that most of the occupiers are of a "good class of people," it would seem that Mr. Glendenning's sympathy is misplaced, as obviously anyone who entirely disapproved of the company's scheme would refuse to become a consumer.

Another point: A number of residents faced with the domestic servant problem, find their worries very considerably reduced by the aid of a very cheap supply of electricity for cooking, heating, cleaning, &c.

I am quite sure, if purely for æsthetic reasons underground mains with their relatively expensive services to consumers' houses had been laid, the company's charges for electricity would have been at least double the present rate, and in this event a large number of the existing consumers would have been prohibited from obtaining the benefits now available.

Any frontage owner could have had the mains laid underground past his property by paying the difference; up to the present, only one such owner has decided to adopt this arrangement, with, in my opinion, every good reason for so doing.

It should also be noticed that where a compulsory crossing of the road has occurred, through the company's inability to obtain wayleave, heavy guarding has been at once involved, and this is probably the principal cause of Mr. Glendenning's complaint.

If rural distribution is to be a commercial proposition, the capital cost must be kept within certain limits, and while telephone and telegraph poles are tolerated, often on both sides of the road, I fail to see why the same concession should not be granted, from a utility point of view, for electric power poles.

I think the whole question can be summed up in the statement that overhead lines properly run are no more unsightly than existing poles for telephones, wireless, &c., and that rural districts prohibiting such a system will have to wait a very considerable period before any commercial company will undertake the very great risk of giving a supply with an abnormal first cost for cables and services.

It is, I believe, a matter of cheap electricity or none at all in many rural areas, and I am quite sure the Brundall consumers would vote solidly for a supply of electricity with the poles, in preference to no supply at all.

G. Redgment.

Norwich, *December 12th*, 1925.

Discussions at the Institution of Electrical Engineers.

I am glad to know that some attention is being given to the question of the hour at which I.E.E. meetings end, and I hope that this attention will be extended to the question of the hour at which they begin.

During the war, when restrictions were many, and travelling was difficult, to say nothing of the dangers from the air that attended upon being out too late, the custom grew up of holding the meetings at 6 o'clock; but nowadays there is no reason why, if members wish, they should not be held later. I am aware that a vote was taken on the subject some time ago, and presumably a majority was obtained for continuing the present practice, but I suggest that this is not a matter which should be decided by the greater convenience of the greatest number, but by the average convenience of all. No doubt gentlemen whose business operations are carried on within reasonable reach of the Embankment like to get to the Institution by about 5.45, have a cup of tea, attend the meeting and get home by about 8.30, but I do not know whether it is realised that some of us whose business operations are carried on a little way out of London can never by any chance get to a meeting at 6 o'clock without making special arrangements, which are often very inconvenient and difficult to make. If the informal meetings can be held at 7 o'clock, why cannot the ordinary general meetings? Personally, I should prefer them at 8 as in the old days, but I would be willing to compromise on 7, and it would at least enable me to put in an appearance at meetings, which I can never do now.

A. J. Cridge.

London, *December 12th*, 1925.

Parliamentary News.

(By Our Special Parliamentary Reporter.)

Wireless Telegraphists' Wages.—On December 7th, Sir A. STEEL-MAITLAND, the Minister of Labour, informed Mr. Lansbury that the rates of salary of wireless telegraphists as agreed upon between the London and District Association of Engineering Employers (on behalf of the Marconi International Marine Communication Co., Ltd., and Siemens Bros. and Co., Ltd.) and the Association of Wireless and Cable Telegraphists, before December 1st were £8 17s. 6d. per month in the first year of service, rising by annual increments to £20 in the ninth year. The reduction as from December 1st, of which notice was given, was 22s. 6d. per month. The agreement contained no reference to the actual hours of duty, but provided that the telegraphist should give his whole time and attention to the discharge of his duties.

Ships Without Wireless Operators.—On December 7th, Sir P. CUNLIFFE-LISTER, President of the Board of Trade, informed Mr. Lansbury that returns from the principal ports showed that up to Friday evening, December 4th, 25 passenger ships and 124 cargo ships had sailed without wireless operators.

On December 9th Sir B. CHADWICK informed Mr. Kennedy that according to the returns from the principal ports, the number of ships coming under the provisions of the Merchant Shipping (Wireless Telegraphy) Act, 1919, which had proceeded to sea with operators holding only restricted certificates up to the end of the previous week was 9; the number which had at least one operator, but not the number required by the rules, was 13; while 178 ships had no operators at all.

Census of Production.—On December 7th, Sir P. CUNLIFFE-LISTER, President of the Board of Trade, informed Mr. R. Wilson that the forms on which the returns for the Census of Production in 1924 were to be made were issued some months ago to those from whom returns were required. About 60 per cent. of those forms had been received back, with more or less complete particulars shown on them. Reminders were being sent to firms who had not returned the forms, asking that the particulars might be furnished immediately. Until a large part of the outstanding returns had been secured, he would not be in a position to state when the summarised results for the principal industries were likely to be available for publication, and regretted very much that so much delay should occur in securing this very valuable information, and he appealed to all firms in default to respond at once to these requests for information.

Lead Poisoning.—On December 10th, Mr. ROBINSON asked the Home Secretary how many cases of lead poisoning occurred among pasters engaged in the manufacture or repair of electric accumulators in the years 1921, 1922, 1923, and 1924

respectively; and whether any cases had been reported since the new code of regulations came into force on March 1st, 1925.

Sir W. JOYNSON-HICKS said that there were five such cases reported in 1921, 11 in 1922, 44 in 1923, and 42 in 1924. Since March 1st last there had only been 15 cases among pasters. The new regulations could not be expected to have their full effect for a considerable time, but they appeared to have already caused a substantial reduction in the number of cases.

Engineering Exports.—On December 10th, in reply to Captain A. Evans, who asked what was the average value of engineering exports in 1925, Sir B. CHADWICK, Parliamentary Secretary to the Board of Trade, said that the average values per ton of exports, from the countries named, of all descriptions of machinery, including electrical machinery and locomotives and tractors, during the first nine or ten months of 1925, were as follow:—United Kingdom (10 months), £95 per ton; Belgium, including Luxemburg (9 months), £41; Germany (9 months), £82; France (10 months), £53.

Bedfordshire, Cambridgeshire and Huntingdonshire Electric Power Bill.—This Bill came before an Unopposed Committee of the House of Commons on December 10th. Mr. SEAGAR BERRY, for the promoters, said that the Bill had been an early one, and in the ordinary course of events would have passed through Parliament by about July last, as it was unopposed throughout. When the Bill was before the House of Lords it contained a proposal to erect a power station near St. Neots, but at that time Lord Weir's Committee was appointed by the Government to deal with the whole position of the electricity supply industry, and the Ministry of Transport told the promoters that it would be inconvenient for the Bill to be proceeded with at that stage. Consequently, the Bill was taken out of the group into which it had been placed for consideration by the House of Commons and put back. Subsequently the Ministry of Transport informed the promoters that there would be no objection to the Bill's proceeding on the understanding that the proposal to build a power station was taken out and that there was inserted in the Bill a clause providing for the purchase of the undertaking in 50 years' time by a Joint Electricity Authority, if such an authority should be set up. The mains of the North Metropolitan Electric Power Supply Co. practically touched the boundary of the area scheduled in the present Bill, and that company was prepared to give the promoters of the scheme a sufficient supply of electricity to carry them on for some years, at any rate, until it was known what would be the effect of the Weir report. In addition, the promoters of the scheme were in negotiation with the Peterborough Corporation, and there might be a possibility also of obtaining supplies from Cambridge.

Sir JAMES DEVONSHIRE, who is one of the promoters of the present scheme, as well as managing director of the North Metropolitan Co., formally proved the preamble of the Bill, and the Committee ordered it to be reported for third reading.

Trade-mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 9th. In the case of foreign applications, the names and addresses of the British representatives are also given.

ZF4. No. 455,757. Class 6. Magnetos.—Robert Bosch Gesellschaft, Militarstrasse, Stuttgart. (W. P. Thompson & Co., 12, Church Street, Liverpool.)

Strowger. No. 455,491. Class 8. Apparatus for use in automatic and semi-automatic telephony.—The Automatic Telephone Manufacturing Co., Ltd.

Neutrola. No. 461,183; Neutrola Grand. No. 461,184; and Neutrolette. No. 461,185. Class 8. Instruments and apparatus and parts thereof for use in radio-telephony and telegraphy.—The Fada Radio Co., Ltd. Alexandra House, Kingsway, W.C.

Tensilite. No. 462,776. Class 8. Electric cables.—Callender's Cable and Construction Co., Ltd.

BB Ring Battery (lettering and design). No. 462,557. Class 8. Electric batteries.—G. Bowerman, 10-12, Ludgate Hill, E.C.4.

Goodwinex. No. 463,039. Class 8. Electrical instruments and apparatus.—J. Dyson, 5-7, Godwin Street, Bradford.

Gallaphos. No. 463,487. Class 8. Electric batteries and accumulators.—Batterien und Elemente Fabrik, System Zeiler Gesellschaft, 20, Rungerstrasse, Berlin. (Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.)

Apex (lettering and design). No. 449,549. Class 13. Electric switch and fuse-gear.—Foster Engineering Co., Ltd.

Insuloid. No. 459,079. Class 50. Electric switch covers, switch plates, electric insulators, and insulating preparations and materials.—J. A. Crabtree & Co., Ltd.

Water Power Resources.—In a paper on "The Development of Water Power Resources" read before the Liverpool Engineering Society, Mr. A. E. Malpas analysed the findings of the Water Power Resources Committee, which were published by the Board of Trade in 1921. He reviewed separately the water available and developed in each country of the British Isles, and also Norway. In dealing with Ireland he gave considerable attention to the Shannon Scheme. With regard to Scotland he said steps had been taken under the Lochaber Power Act to extend the activities of the British Aluminium Co., Ltd. The new extension would bring the installed capacity of the plant up to 107,000 e.h.p. The aggregate amounts of undeveloped water power in the countries of Great Britain in 1921, said the author, were: Scotland, 194,965 kW; Wales, 35,900 kW; and England, 20,440 kW.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

12,799. "Amplifying apparatus, particularly for wireless reception." J. Scott-Taggart. May 24th, 1924. (243,038.)

14,722. "Wireless receiving apparatus and the like." J. Scott-Taggart. June 18th, 1924. (243,039.)

19,226. "Production of solutions containing oxides of chromium, and the electrolytic separation of chromium from such solutions." E. Liebreich. August 13th, 1924. (243,046.)

19,415. "System of facsimile telegraphy by wireless signals." E. Belin. August 15th, 1924. (243,049.)

19,591. "Mechanically-connected fluid tap and electrical switch." H. W. Cox. August 19th, 1924. (243,054.)

19,623. "Thermionic valves or vacuum tubes for wireless telegraphy and telephony." C. Seymour, G. Shearing, and H. G. Hughes. August 19th, 1924. (243,056.)

19,638. "Electric alarm devices." R. H. H. Geffcken and R. H. Richter. August 23rd, 1923. (220,945.)

19,754. "Electromagnetic instruments for converting oscillating currents into sound, and vice versa." British Thomson-Houston Co., Ltd., A. P. Young, and J. H. Butcher. August 20th, 1924. (Cognate application 1,630/25.) (243,063.)

19,771. "Crystal and like detectors for wireless reception." W. Smith. August 20th, 1924. (Cognate application 11,885/25, a divided application on 19,771/25.) (243,065.)

19,819. "Electric current collectors for the ignition distributors of internal-combustion engines." L. V. Petersen. August 21st, 1924. (243,067.)

19,822. "Toothed-gearing, particularly suitable for the driving of magneto-electric machines." R. B. North and A. Massey-Allen. August 21st, 1924. (243,068.)

19,823. "Magneto-electric machines." R. B. North and A. Massey-Allen. August 21st, 1924. (243,069.)

19,830. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and W. Aitken. August 21st, 1924. (243,070.)

19,998. "Coin-collecting means for telephone services." Hall Telephone Accessories, Ltd. (F. W. Hall). August 23rd, 1924. (243,080.)

20,238. "Transmission of wave energy for high-frequency signalling." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). August 27th, 1924. (243,088.)

20,425. "Heat-exchangers specially applicable for cooling the circulating air of dynamo-electric machines and the like." Lancashire Dynamo & Motor Co., Ltd., and R. S. McLeod. August 29th, 1924. (243,093.)

21,074. "Telephonic apparatus." V. A. Foot. September 6th, 1924. (243,102.)

22,825. "Glass panels for use in and upon wireless cabinets." H. Rhodes. September 27th, 1924. (243,124.)

23,083. "Electric switchgear." British Thomson-Houston Co., Ltd., H. Trencham, H. C. Heath, and C. W. Newton. September 30th, 1924. (243,125.)

24,514. "Application of two-grid valves." Compagnie Générale de Télégraphie Sans Fil. October 15th, 1923. (223,580.)

25,185. "Electrical switches, circuit breakers, or like appliances." A. Cormond. October 22nd, 1924. (243,136.)

25,412. "Electric lamps, thermionic valves, and the like." Radions, Ltd., and H. J. Osborn. October 25th, 1924. (243,137.)

25,563. "Conductive element for use in the manufacture of, and improvements in, inductance coils or magnetic cores for transformers, electromagnets, or other electrical apparatus." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.) (H. R. Van Deventer). October 27th, 1924. (243,139.)

25,657. "Automatic telephone systems." Relay Automatic Telephone Co., Ltd., B. B. Johnson, and G. A. Hollings. October 28th, 1924. (243,140.)

25,904. "Electric resistances." D. G. E. Barrie and Enterprise Manufacturing Co., Ltd. October 30th, 1924. (243,143.)

26,117. "Electric condensers." H. Stevens and A. J. Stevens & Co. (1914), Ltd. November 3rd, 1924. (243,146.)

26,192. "Electron discharge devices." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) and E. M. Deloraine. November 3rd, 1924. (243,147.)

26,982. "Crystal detectors for wireless receiving systems." G. Edmonds, Ltd., and H. Edmonds. November 12th, 1924. (243,153.)

27,395. "Electrically-operated valves." W. E. Ashley, J. B. Broadhead, H. Tart, and J. Lindsay. November 17th, 1924. (243,155.)

28,581. "Electrical switchgear." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. November 28th, 1924. (243,165.)

29,583. "Headlamps for motor and other vehicles." H. Drabble. December 9th, 1924. (Cognate applications 756/25 and 22,448/25.) (243,178.)

29,681. "Dynamo-electric machinery." British Thomson-Houston Co., Ltd., and F. P. Whitaker. December 10th, 1924. (243,179.)

30,238. "Crossings for overhead electric conductors." A. Wiseman, J. W. Harris, and H. M. Dudgeon. December 16th, 1924. (243,181.)

1925.

277. "Telephone systems." Coventry Automatic Telephones, Ltd., and J. E. Collyer. January 5th, 1925. (243,188.)

961. "Resistance material electrically conductive in a cold state, usable at high temperatures, and method for its manufacture. T. A. F. Holmgren. January 22nd, 1924. (228,142.)

1,641. "End connections and joints for extra-high-tension cables." S. Silbermann. January 31st, 1924. (228,525.)

2,799. "Electron discharge devices." Standard Telephones & Cables, Ltd. (formerly Western Electric Co.) (Western Electric Co., Inc.). January 31st, 1924. (243,200.)

3,326. "Crystal detector for wireless receiving apparatus." C. R. Marshall. February 6th, 1925. (243,201.)

3,991. "Crystal detectors." P. Winocour and H. E. Thompson. February 12th, 1925. (243,206.)

6,090. "Devices for regulating the voltage of dynamos of variable speed and load. A. J. Jullin. June 30th, 1924. (236,163.)

6,092. "Setting device for the elements to regulate the speed of the disk of electricity meters." Landis & Gyr Soc. Anon. March 8th, 1924. (230,475.)

7,802. "Reduction gears for use in adjusting radio tuning instruments." Burndept, Ltd., C. F. Phillips, and S. F. Woodell. March 23rd, 1925. (243,218.)

11,762. "Electric storage batteries or accumulators." H. M. Genese, G. R. N. Minchin, and Pritchett & Gold & E.P.S. Co., Ltd. May 6th, 1925. (243,239.)

12,721. "Pole for carrying cables, telegraph and telephone wires and for other purposes." J. C. Stobie and F. W. H. Wheadon. July 15th, 1924. (237,221.)

13,179. "Electric fuses." J. H. Hickey and G. E. Beattie. May 20th, 1925. (242,243.)

14,048. "Reception apparatus for wireless." N. Lawton. May 28th, 1925. (243,252.)

14,406. "Electric connection and switch-boxes." P. S. Glover. June 2nd, 1925. (243,254.)

15,113. "Telegraph typewriters." Kleinschmidt Electric Co., Inc. July 5th, 1923. (Divided application on 218,643.) (235,572.)

15,115. "Telegraph typewriters." Kleinschmidt Electric Co., Inc. July 5th, 1923. (Divided application on 218,643.) (235,574.)

15,118. "Telegraph typewriters." Kleinschmidt Electric Co., Inc. August 11th, 1923. (Divided application on 220,280.) (235,577.)

15,786. "Induction motors." British Thomson-Houston Co., Ltd. June 30th, 1924. (235,897.)